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**A Model for the Measurement and Presentation of  
Participation Awareness in Online Groupware Systems**

A thesis submitted to the Graduate Research School in fulfilment  
of the requirements for the degree of

**Doctor of Philosophy**

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School of Computer and Security Science

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## USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

## Abstract

The need to support effective group work in online environments has become a prominent issue in both education and enterprise. Universities continue to adopt constructivist-based learning strategies which see learners engage in group work to build knowledge, coupled with an increase in online and distance learners. In enterprise, where group or team based work is commonplace, the prevalence of the Internet has seen the emergence of teams that collaborate wholly or partially online.

In response to this emergent need, groupware, software used to support online group work, has become widely used in both education and enterprise. Although based upon sound pedagogical principles, the use of groupware does not always meet expectations or compare favourably to face-to-face collaboration. The literature has identified the issue of awareness, defined by Dourish and Bellotti (1992, p. 107) as “an understanding of the activities of others, which provides a context for your own activity”, as a core factor in the effectiveness of groupware. Numerous awareness mechanisms have been developed and implemented into groupware applications, aiming to replace the information that is implicit in face-to-face collaboration, but largely absent in online environments.

This study defined and modelled a new form of awareness named ‘participation awareness’, which aggregates and processes activity in a groupware environment in order to present a persistent display of group member participation. A field study was conducted, wherein university students utilised a groupware application named GroupShare to support group work required in their studies. GroupShare contained an implementation of a participation awareness mechanism, and participating students completed pre and post-usage questionnaires primarily concerning group work and the participation awareness mechanism. Further survey and observational techniques were also utilised to gather data. Two iterations of the field study were conducted, each running for one semester.

Analysis of the data found that the participation awareness mechanism was well received, eliciting largely positive responses from a range of participant demographics,

group dynamics and group work scenarios. Participant feedback was utilised to define and refine the constituents of participation awareness and create a generic model for its implementation as an awareness mechanism. The model outlines the steps and considerations required to capture and process activity within a groupware environment, and establishes three complimentary methods of presenting participation awareness. The author feels that the research was successful in creating and justifying a model of participation awareness which can be implemented in groupware environments and utilised in further research.

## Declaration

I certify that this thesis does not, to the best of my knowledge and belief:

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# Chapter 1 – Introduction and Background

## *1.1 Introduction*

Collaborative learning has become a core component of modern education, aiming to provide learners with the skills needed in the workplace as well as knowledge in a specific discipline (Bruckman, 2006; Desjardins & van Oostveen, 2008; Dochy, Segers, & Sluijsmans, 1999; Tribe, 1994). This shift from traditional education methods is largely due to the adoption of constructivist-based learning strategies, founded on the works of those such as Dewey (1916), Piaget (1952, 1954), Vygotsky (1962, 1978) and Bruner (1985, 1996). Huang (2002) summarises the theories of constructivism in saying that knowledge is seen to be “constructed by learners through social interaction with others” (p. 33) and discusses “the critical importance of interaction with people, including other learners and teachers, in cognitive development” (p. 29). Such pedagogical ideals are a substantial departure from the largely passive and instructor-centric methods of traditional education methods. This evolution of pedagogy is apparent in the increasingly frequent group-based work and assessments undertaken by learners in higher education. The majority of modern learners will engage in group work on numerous occasions throughout their studies, ranging from short group discussions to prolonged team projects.

The importance of constructivist-based collaborative learning is emphasised in the Online Learning Environments (OLEs) often implemented by universities and other higher education institutions. Driven by today’s Internet-enabled society and the increasingly busy lives of learners, OLEs allow universities to deliver distance education and supplement campus-based courses by providing ‘anywhere, anytime’ access to course content (Barab, Thomas, & Merrill, 2001; J. Clark, 2000; Hiltz, 1997; Streeter, Lochbaum, LaVoie, & Psocka, 2007; Whatley, 2004). Research has found collaborative learning to be crucial to the effectiveness of online learning. Collaborative learning helps to improve educational outcomes and reduce the high rate of attrition common in online environments (Cain & Pitre, 2008; Desjardins & van Oostveen, 2008; Francescato et al., 2006; Hiltz, 1997; Hiltz, Coppola, Rotter, & Turoff, 2000; Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999). While OLEs are suited to

course content delivery and feature some tools to support communication and collaboration, specialised software is often necessary to provide the sophisticated environment required for complex or prolonged group work (Bannon, 1995; J. Clark, 2000; Stahl, Koschmann, & Suthers, 2006). Software used to facilitate collaboration in an online environment is commonly referred to as groupware, and in parallel to its use in education, groupware is often used to support group-based work or projects in enterprise environments (Bahli & Büyükkurt, 2005; Dourish & Bellotti, 1992; Gibson & Cohen, 2003; Grudin & Poltrock, 1997). Groupware environments typically provide a central repository or 'common space' in which group members can collaborate, communicate and coordinate their activities.

A significant issue in the area of groupware environments is that of awareness, defined by Dourish and Bellotti (1992, p. 107) as "an understanding of the activities of others, which provides a context for your own activity". In face-to-face collaboration, a high degree of awareness is inherent and taken for granted, however when collaboration is conducted in a groupware environment much of this is lost and group members must often make conscious effort to determine the activities of their peers (Biehl, Czerwinski, Smith, & Robertson, 2007; Gutwin & Greenberg, 1996, 2004; Olson & Olson, 2009; Steinfield, Jang, & Pfaff, 1999). Research in the area of awareness in groupware environments has resulted in the development of a number of awareness mechanisms aimed at making group members aware of each other's past, present and predicted future activities in order to facilitate effective collaboration (Borges & Pino, 1999; Dourish & Bellotti, 1992; Gutwin & Greenberg, 2004; Kirsch-Pinheiro, De Lima, & Borges, 2003). A common example of an awareness mechanism is a list of recent events within a groupware environment, which serves to inform group members of actions that may have occurred since their last visit. Mechanisms such as these facilitate effective group work by raising the level of awareness amongst group members in groupware environments, which is of particular importance when collaboration takes place in an asynchronous and indirect manner.

This research investigates 'participation awareness', a new form of awareness and associated awareness mechanism for groupware environments. A thorough examination of the literature has identified a gap in research regarding forms of

awareness which provide an aggregated and persistent display of group member participation in an at-a-glance manner. In this and prior research (Baatard, 2006, 2007a), the author has utilised the term ‘participation awareness’ to represent such a form of awareness. Participation awareness continually aggregates records of activity within a groupware environment and presents it in a manner which can be interpreted at-a-glance, providing group members with a better awareness of participation in collaborative work. Of the numerous awareness mechanisms that have been developed and implemented, many are only applicable to specific groupware applications or collaborative activities. The literature has noted a lack of generalisable awareness mechanisms (Gutwin & Greenberg, 2002; Kirsch-Pinheiro et al., 2003). The aim of this research is to develop and test a model of participation awareness that is generically applicable, facilitating both the implementation of a participation awareness mechanism into any groupware environment and further research into its applicability and impact.

## ***1.2 Background to Research***

This research arose from prior research by the author which investigated the impact that certain features in an online groupware application had on collaboration (Baatard, 2006). The features investigated previously were peer review and an initial form of participation awareness. The application, developed by the author, was named Reportal, and allowed users to collaboratively author lengthy structured documents such as project plans in an online environment. While the peer review features of Reportal received a positive response from student participants, participation awareness received a mixed response. Participation awareness, as implemented in the prior research, was perceived by participants to be inaccurate due to the quantitative nature of the metrics, though the participants did recognise the potential benefits of a participation awareness mechanism in online group work. Figure 1.1 illustrates the participation awareness mechanism implemented in the prior research (Baatard, 2006). The left side of the figure shows the area of the main page of the application that presented the awareness information, while the right side of the figure shows the additional information which was available to participants by clicking the information icon beneath the statistics. This research takes into account the findings of the prior



research, and further develops the concept and implementation of participation awareness.

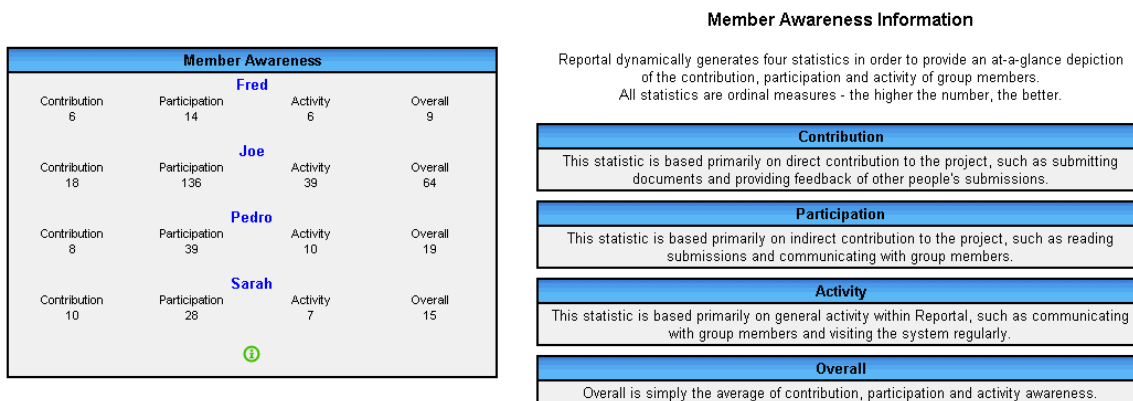


Figure 1.1 – Participation awareness mechanism in prior research by the author

In discussion derived from the prior research, both student participants and teaching staff expressed difficulty in forming a clear understanding of participation in group projects, particularly when the some or all of the work was conducted out of class or in an online environment. Both groups desired a system which would allow them to keep track of individual participation in group projects, feeling that it could improve the effectiveness of group-based work. The potential benefits of a groupware environment with an increased awareness of participation and past events has been recognised in the literature, with Preguiça, Martins, Domingues and Duarte (2000, p. 69) stating that “overall information about the evolution of the collaborative activity ... may improve each user’s contributions.” This is cited by Kirsch-Pinheiro, De Lima and Borges (2003), who propose a framework for past event awareness support, which they claim is “still absent in many groupware systems” (p. 14). While the framework proposed by Kirsch-Pinheiro et al. (2003) fulfils similar awareness needs than participation awareness, it differs from participation awareness in that it focuses on providing explicit details of past events, rather than an aggregated at-a-glance display of ongoing participation. The framework of Kirsch-Pinheiro et al. also has a heavy emphasis on filtering awareness information based on group member roles and profiles – the existence or implementation of which varies greatly amongst different groupware environments. This further distinguishes it from this research, as a mechanism with an emphasis on such factors would not be generically applicable.

Research by Borges and Pino (1999) involved the development of a 'Participameter', which displays a summary of individual group member participation, including graphical elements for rapid interpretation. This mechanism is similar to the participation awareness proposed by the author, however its conceptual basis differs substantially. While participation awareness is intended primarily for the benefit of group members, the Participameter is intended for group coordinators, in order to highlight any disharmony, alienation or non-participation in a group – it is not available to group members themselves. Zumbach, Hillers and Reimann (2004) implemented an awareness and feedback mechanism which aggregated records of contribution and presented them in a pie chart within in a groupware environment. This approach is very similar to the concept of participation awareness, but with a lower degree of sophistication. Research such as Kirsch-Pinheiro et al. (2003), Borges and Pino (1999) and Zumbach et al. (2004) illustrate that the literature has identified a place for participation awareness in groupware and underpins its importance in supporting effective collaboration.

Based on publications by Byrne (1990), Galliers (1994) and Saunders (1998), Benbasat and Zmud (1999) voiced the opinion that a large amount of Information Systems (IS) research lacks relevance to practice because it does not address enduring or current issues in the field, or provide useful or implementable solutions (pp. 4-5). Benbasat and Zmud (1999) state that this lack of relevance has contributed to a lower degree of interest in IS research from professionals in the field, and make a number of recommendations intended to increase the relevance of IS research. Foremost amongst these recommendations are the selection of topics which are of interest to both the business and academic IS communities, and the production of useful and applicable findings (pp. 7-12). While dated, the author feels the recommendations are still largely relevant, and takes heed of them in the current research; awareness is an issue of high importance to online collaboration in both education and enterprise, and a model of participation awareness is of use to researchers, practitioners and developers alike. It should be emphasised at this point that the research is IS based. While the evaluation of a participation awareness mechanism from educational or social science perspectives are perfectly valid, this research aims to develop a generic model on which such a mechanism could then be founded and tested. It is the

development of the model, not its application or impact, which is the focus of this work.

### ***1.3 Research Questions***

The aim of this research is to develop a generically applicable model of participation awareness, which if implemented as an awareness mechanism, is capable of generating and displaying an ongoing measure of group member participation in a groupware environment. The primary research question is:

*What are the constituents of a generically applicable model of participation awareness for groupware environments?*

While the author's prior research (Baatard, 2006) implemented a basic participation awareness mechanism and evaluated its impact on collaboration, the elements which contribute to participation awareness were not examined or defined in great depth. This research identifies, implements and evaluates these constituents to ensure that the participation awareness model is effective and generically adoptable. In order to address the primary research question, two supporting questions have been defined. These questions investigate the two key elements of the proposed model – the metrics of participation, and the presentation of participation awareness. The first supporting question is:

*What are the key metrics and processes required to autonomously measure participation in online group work?*

Measuring participation is central to the model, and therefore this research question focuses upon the identification and processing of possible metrics. As the model aims to define an autonomous mechanism, the metrics of participation must be drawn from measurable events and actions within the groupware environment, such as logins, contributions of work, or providing feedback on contributed work. These events are not limited to direct contributions to the collaborative task at hand. Ogata and Yano (1998) distinguish between direct and indirect participation. This concept is also acknowledged by Borges and Pino (1999), who state that “while contribution may be measured by the number of statements or tasks generated by a member to the group,

the notion of participation is subtler. A group member might be participating by simply accessing other member's contributions" (p. 72). The issue of qualitative metrics arose in the prior research (Baatard, 2006) where participants recognised that an autonomous mechanism cannot, by nature, determine the quality of participation. In order to identify the metrics of participation thoroughly, factors such as indirect participation and qualitative metrics are addressed in this research. The metrics of participation, and hence the scope of the first supporting question, are not limited to the events and actions themselves, but also include the way in which these are processed to create participation awareness information. This entails aspects such as any weighting or limits applied to actions in order to reflect their relative value as a metric of participation. As the research aims to develop a model that is generically applicable, a comprehensive or prescriptive list of groupware events and actions is not considered appropriate. Rather, it is the establishment of guidelines and frameworks for the identification, capture and processing of participation metrics that is the focus of the first supporting question.

Borges, Pino and Valle (2001) discuss the importance of presenting awareness information in such a way that avoids 'polluting' the interface or resulting in information overload. The second supporting question regards the presentation of participation awareness data:

*How can participation awareness be presented in a groupware interface such that it is deemed effective by those making use of it?*

The presentation of participation awareness data is of high importance, as different methods of presentation have the potential to influence the effectiveness and perceived precision of the model (Baatard, 2006, 2007a; Steinfield et al., 1999). Participation awareness data can be displayed in many fashions, such as textually, numerically and graphically. The data being presented can also vary; from raw statistics to summarised, collated and abstracted data. While the presentation of awareness mechanisms has not been extensively researched in the literature, some studies have addressed the issue. Gutwin (1997, p. 72) states that "after workspace awareness information has been collected and distributed, it must be displayed in the groupware interface ... the designer must determine where and how to display each

piece of workspace information.” Gutwin (1997) then goes on to identify a number of dimensions relating to the display of awareness information, including placement, presentation and granularity. Although oriented towards synchronous collaboration, the dimensions identified by Gutwin are relevant to the presentation of participation awareness. Awareness presentation issues are also recognised by Steinfield, Jang and Pfaff (1999), who discuss issues such as the potential for information overload caused by autonomous awareness mechanisms, whether they should be focal or peripheral within the interface, and whether their display should be fixed or customisable by groupware users.

Several researchers have experimented with novel methods of displaying awareness information in online discussion. A graphical interface for online discussion named Chat Circles used coloured circles to reveal “the level of activity, or lack thereof, of each participant” (Viegas & Donath, 1999, p. 11). Similarly, Erickson et al. (1999) represented participants of an online conversation as coloured dots within a circle, with active participants appearing closer to the centre of the circle. While concerning participation in synchronous online discussion, the underlying concepts are similar to those of participation awareness, and the presentation methods employed are of relevance to the research.

The metrics and presentation of participation awareness information are the two primary constituents of a model of participation awareness. By investigating each of them in depth, the author seeks to address the primary research question, resulting in a generically applicable model of participation awareness.

### ***1.4 Significance of the Research***

Given the importance of group work in modern education and enterprise, it is not surprising that a large number of research studies have been conducted over the years regarding the facilitation of collaboration in online environments (Borges, Brézillon, Pino, & Pomerol, 2005; J. Duffy, 1996; Haythornthwaite, 2006; S. C. Hughes, Wickersham, Ryan-Jones, & Smith, 2002; Lehtinen et al., 1999; Rich, Cowan, Herring, & Wilkes, 2009; Stacey, 2000; Vonderwell, 2003, to name a few). The research ranges

from fostering a sense of social presence to making the most of asynchronous text-based communication, however a significant section of it is dedicated to the issue of awareness in groupware. Awareness mechanisms fall into two main categories, those which support synchronous collaboration, and those which support asynchronous collaboration. Synchronous awareness mechanisms provide users with 'up-to-the-moment' information about activity in the environment in order to facilitate real-time interactive collaboration, while asynchronous awareness mechanisms alert typically users to past events and actions which may otherwise have gone unnoticed (Preguiça et al., 2000). Awareness mechanisms aim to replace information regarding the activities of group members which is implicit and often taken for granted in face-to-face collaboration, but lost or obfuscated in online environments. A high level of awareness contributes greatly to the potential effectiveness and success of collaboration in an online environment (Carroll, Rosson, Convertino, & Ganoë, 2006; Gutwin & Greenberg, 2004; Steinfield et al., 1999). Despite the large amount of awareness research, there has been little investigation into forms of awareness which collect, aggregate, and persistently display data throughout a collaborative project. By identifying the constituents of participation awareness, this research provides a model that researchers, developers and users of all collaborative software can use as a basis to implement a participation awareness mechanism suitable for their needs. While this research does not aim to evaluate the educational impacts of participation awareness, its appropriateness is justified by the recognised need for awareness mechanisms in groupware environments and the positive effects of similar mechanisms observed in the literature. The appropriateness and effects of such a mechanism was also evidenced in prior research by the author (Baatard, 2006).

In an educational environment, teaching staff who implement online collaborative tasks can benefit from a mechanism that allows them to see the degree to which learners have participated in the groupware environment. The learners themselves can benefit in knowing that their participation, or lack thereof, will be succinctly and objectively displayed to the whole group. While this may appeal to some students more than others, the prior research (Baatard, 2006, p. 59) found that overall, participants reported that participation awareness encouraged them to be more active in online group work and to work harder. Sustained participation and equal

contribution in group work are two of the primary apprehensions students have in regards to group work (Baatard, 2006; Barfield, 2003; Monk-Turner & Payne, 2005; Wulf, 2005). These issues may be lessened by the inclusion of a participation awareness mechanism. These potential benefits are equally applicable to an enterprise environment, where project managers or coordinators appreciate knowing who has been participating, and where group members can see that their contributions have been recognised. While participation awareness may well have an impact on educational or project outcomes, this falls outside the scope of the current research. The definition and development of a generically applicable model of participation awareness will facilitate further research into the effects of participation awareness mechanisms.

Increased awareness in groupware promotes more effective online collaboration, an issue faced in both educational and enterprise environments. Aggregated and persistent forms of awareness such as participation awareness have not been significantly explored in the literature, though their appropriateness has been established. This research aims to develop a generic participation awareness model that can serve as a basis for further research and a framework for the implementation of participation awareness in new or existing groupware applications.

### ***1.5 Glossary of Terms***

A glossary of the core terminology used throughout this thesis has been compiled, for quick reference where needed. The glossary defines terms relating to all elements of the research and participation awareness. It is located in Appendix A.

## **Chapter 2 – Literature Review**

As stated previously, a gap has been identified in the current literature relating to awareness in groupware. In order to explore this gap further and to provide an overview of the current state of knowledge in the areas relevant to this research, a review of the literature is required. This literature review examines the core areas upon which the research is based – those of constructivism, collaborative learning, online education, groupware, and awareness.

The emergence of constructivist-based pedagogies is discussed and compared to traditional education methods. The concept of collaborative learning, a learning strategy founded upon constructivist ideals, is then introduced. While initially discussed in the context of education in general, collaborative learning is further examined in the context of online education. The evolution of online education is discussed in the second section of the literature review, detailing the influence of technology and pedagogy on this area and the importance of collaborative learning in online education. The concepts and attributes of various forms of groupware are then introduced. This area of literature influenced the design and development of the groupware application used in the current research. The final section of the literature review examines the issue of awareness in groupware, including discussion of common defining terminology, different types of awareness, and some of the awareness mechanisms which have been implemented in groupware systems. The section focuses upon the literature that relates the most directly to participation awareness. The aim of this literature review is to explore the concepts, literature and state of affairs in the areas pertinent to this research.

### ***2.1 Constructivism and Collaborative Learning***

The first section of this literature review examines the concepts of constructivist pedagogy and collaborative learning. The theories of constructivism are described and compared to the traditional, instructor-centric, models of higher education. Collaborative learning, a learning strategy which embodies the fundamental tenets of



constructivism is then introduced. The implementation and impact, both idealistic and realistic, of collaborative learning is examined, and supporting topics are discussed.

### **2.1.1 From Traditional Education to Constructivism**

Traditional education generally adheres to what is sometimes described as ‘objectivist pedagogy’ or ‘didactic instruction’, where the instructor is seen as the subject matter expert and the primary source of knowledge. Learning is treated as a largely one-way process, with the instructor transferring knowledge to learners via direct instruction such as a lecture (Alavi, 1994; A. Brown, 1997; Connolly & Stansfield, 2007a; Johnson, Johnson, & Smith, 1998a; Wulf, 2005, p. 245). Such a method of education has been the mainstay of most higher education institutions for generations and has been recognised historically as a generally successful and effective pedagogy. In more recent times however, the failings and limitations of traditional education methods have become increasingly apparent. Summarised into three pertinent areas, the literature commonly recognises the following as the core failings of traditional educational methods:

- Does not impart learners with interpersonal, communicative and group work skills required in modern workplaces.
- Often fails to accommodate for different types of learners and learning styles by relying too heavily on the memorisation and retention of facts.
- Often results in a shallow knowledge acquisition, where facts and information are memorised, but not actively reflected upon or understood at a deeper level.

The prominence of the first and third of these issues can be attributed, at least in part, to the requirements of enterprise and industry. Modern workplaces require employees who possess not only skills, understanding and knowledge of their profession, but the interpersonal skills needed to work effectively with others in a team (Alavi, 1994; Boud, Cohen, & Sampson, 2001; Thorley & Gregory, 1994; Tribe, 1994; Tynjälä, 1999; Wulf, 2005; Zhang & Nunamaker, 2003). The second issue is a consequence of the largely passive and one-way nature of traditional education methods.

Throughout the twentieth century, theories of learning and education emerged that challenged the instructor-centric methods of traditional education, and contributed towards what is today known as constructivist theory or constructivism. In constructivist theory, learning is posited as an active and interactive process, as opposed to the largely passive and independent processes of traditional education (Franciscatoa et al., 2006; Hiltz et al., 2000; Loyens, Rikers, & Schmidt, 2006; Slavin, 1996; Tynjälä, 1999; Wesley, 2004). A major influence on modern constructivism are the theories of Russian psychologist Lev Vygotsky (1962, 1978). Vygotsky proposed that learning occurs in a social context, with learners constructing knowledge through their experiences and interactions – not only with traditionally recognised sources of knowledge such as instructors, but also with their peers. Of particular relevance is Vygotsky’s theory of the “zone of proximal development” (Vygotsky, 1978), which describes the process by which an instructor or more advanced peer can ‘scaffold’ the development of a learner by providing assistance until the learner achieves independent knowledge or capabilities. These theories support Dewey’s (1916) view that knowledge should be dynamically built and discovered by and amongst learners, with instructors taking a “guide on the side” role rather than that of a “sage on the stage” (T. Clark, 2003; Hiltz & Benbunan-Fich, 1997; Huang, 2002). Other individuals and works which have contributed to constructivist theory include Piaget (1952, 1954), Bruner (1960, 1985, 1996) and Watzlawick (1984), however a detailed examination of the foundations of constructivism is outside the scope of this research.

Having evolved from such numerous and diverse origins, it is of little surprise that providing a modern definition of constructivism is a challenge – “As a term as well as a concept, constructivism presents itself almost as indefinable. Current educational literature, to be sure, is littered with a range of definitions for and understandings of this concept” (Wesley, 2004, p. 180). Constructivism concerns the construction of knowledge and the process of learning, and hence does not represent a specific pedagogy. However, its theories are the basis of numerous teaching and learning strategies which promote active and collaborative learning. In light of this, the author has chosen to summarise the concepts of modern constructivism primarily from the perspective of its relevance to teaching and learning strategies in higher education, rather than from a psychological or philosophical perspective. In doing so, the

relationships between the concepts and theories of constructivism and the current research are more clearly expressed. Table 2.1 presents an overview of the tenets of modern constructivism in higher education compared to those of traditional education. The content of the table has been synthesised from a wide range of literature, including the works that have been previously cited and others such as Wertsch (1997, 1985), von Glasersfeld (1989), Johnson, Johnson and Smith (1998a) and Duffy and Jonassen (1992).

Table 2.1 – Comparison of traditional and constructivist-based education methods

<b>Traditional education</b>	<b>Constructivist-based education</b>
<b>Learners</b>	
Learner is largely passive. Socio-cultural context of learner is of low relevance. Interaction amongst learners is of low relevance.	Learner is active and responsible for learning. Socio-cultural context of learner is of high relevance. Interaction amongst learners is of high relevance.
<b>Instructors</b>	
Instructor is responsible for teaching – imparting knowledge to learners. Instructor seen as the primary source of knowledge.	Instructor is responsible for facilitating learning – assisting learners to actively construct knowledge.
<b>Learning</b>	
Learning is a largely passive process. Knowledge is delivered to learners by the instructor.	Learning is an active and social process. Learners construct and scaffold knowledge via interactions and experiences with instructors and peers.
<b>Learning Activities &amp; Assessment</b>	
Learning activities are largely one-way (e.g. lectures). Practical activities and assessments test knowledge and understanding of theory. Assessments emphasise concept of ‘correct answer’.	Learning activities involve collaborative, social and interactive tasks based on solving realistic problems. Assessment of learning process as well as outcomes. Assessment is interactive process where learner demonstrates knowledge to instructor.

The term “constructivist learning environment” (Connolly & Stansfield, 2007a; Jonassen, 1992; B. G. Wilson, 1996) is often used to describe a learning environment which implements the tenets of constructivism, as presented in Table 2.1. In a constructivist learning environment, learners are presented with a problem which they are to solve in an active and collaborative manner, scaffolding and constructing knowledge with their peers. While the instructor may present content or theory to support the learners, the role of the instructor is that of a facilitator.

While the concepts and theories of constructivism as a whole form an important part of this research’s theoretical framework, it is the collaborative aspects which are of particular relevance. By engaging in group-based tasks with their peers, learners are able to construct and scaffold knowledge in an active manner. Tribe (1994, pp. 25-26) summarises the importance of active group-based learning in higher education:

The skills objectives of group-based learning cover such interpersonal competences as oral communication; active listening; group leadership; group membership; the ability to examine assumptions; and the ability to tolerate ambiguities. All of these skills are highly valued in employment. .... Active involvement is necessary if 'real' learning is to occur. A major (and generally unquestioned) objective of higher education is to teach students to think, yet an examination of methods of teaching currently in use shows that students spend the majority of their working time passively receiving information and taking notes, rather than actively performing cognitive operations on the material to be learned.

As well as reiterating some of the constructivist principles that group-based learning is founded upon, this quote mentions the importance of developing the interpersonal skills required in the workplace, and thus addresses one of the common failings of traditional higher education. The term 'collaborative learning' is often applied to learning strategies that emphasise the principles of constructivism (Bruffee, 1981; Gokhale, 1995; Goodsell, Maher, & Tinto, 1992; Haring-Smith, 1993; Johnson & Johnson, 1975, 1989; Johnson, Johnson, & Holubec, 1990; Wiener, 1986). In examining the literature in this domain, it rapidly becomes apparent that a multitude of names and labels has emerged for constructivist-based learning strategies which emphasise the importance of collaboration amongst peers in learning. These include cooperative learning, peer learning, collective learning, group-based learning and team-based learning. This thesis adheres to the term collaborative learning, unless directly discussing a piece of literature in which another term is utilised.

The constructivist foundations of collaborative learning are well illustrated by Alavi (1994), who describes three attributes of effective learning. The first attribute, active learning and the construction of knowledge, emphasises the need for learners to be actively engaged in "acquiring, generating, analyzing, manipulating, and structuring information" (p. 161). Cooperation and teamwork in learning is the second attribute, supporting the principles of constructing knowledge in a social context through interaction with peers (Vygotsky, 1978). Alavi's final attribute of effective learning is learning via problem solving. This attribute aligns with other constructivist theories (Dewey, 1916; Huang, 2002) by maintaining that learning is expedited by using "challenging problem-solving situations in which mental models are tested, extended, and refined until they are effective and reliable in solving that problem" (Alavi, 1994,

p. 161). Alavi (1994) argues that collaborative learning is a learning strategy which embodies these three attributes of effective learning:

It involves social (interpersonal) processes by which a small group of students work together (i.e., cooperate and work as a team) to complete an academic problem-solving task designed to promote learning (i.e, get actively involved and participate in problem solving). (p. 161)

Johnson and Johnson have published prolifically (Johnson & Johnson, 1975, 1989; Johnson, Johnson, & Holubec, 1998; Johnson, Johnson, et al., 1998a; Johnson, Johnson, & Stanne, 2000 – by no means an exhaustive list) on the concept of ‘cooperative learning’, a learning strategy akin to collaborative learning as defined by Alavi (1994) and used in this thesis. In their works, cooperative learning is often compared to ‘competitive learning’ or ‘individualistic learning’, where learners work alone to be the best amongst their peers or against pre-set criteria, and are assessed as such – concepts with strong ties to traditional education methods. Cooperative learning involves the same core principles and values of collaborative learning, with learners actively scaffolding and constructing knowledge and interpersonal skills by working in groups to solve realistic problems. While some researchers have defined a difference between cooperative and collaborative learning (Panitz, 1997), the concepts and terms are frequently used in an interchangeable manner in the literature.

Group projects are becoming a central feature of many college courses. The growth in group projects parallels the increased use of active learning strategies which are often characterized as collaborative or cooperative learning strategies. (Payne & Monk-Turner, 2006, p. 132)

Collaborative learning is a commonly implemented learning strategy in higher education. It is based upon constructivist theories and addresses the primary failings of traditional education methods by being learner-centric, active, and involving problem solving and collaboration amongst peers. While this research is based in the area of Information Systems (IS), collaborative learning is the learning strategy which underpins the theoretical framework of the research from an educational perspective.

### **2.1.2 Implementation and Impacts of Collaborative Learning**

Collaborative learning, as presented in Section 2.1.1, is a desirable and pedagogically sound learning strategy. However, the implementation of collaborative learning in higher education often does not fully live up to these ideals. According to Boud, Cohen and Sampson (2001), collaborative or peer learning is commonly added to courses that are still based in traditional instructor-centric pedagogy. Such additions are seen by the instructors as a method of enhancing students' learning experiences and exposing them to learning processes that reflect those encountered in the workplace. However, sometimes more pragmatic motivations exist such as using group-based work as a method of managing large classes or workloads. While the first of these motivations is well intended, attempting to add collaborative learning into a course structure based heavily on traditional education methods is not an ideal implementation of a constructivist learning strategy. The failings or lacklustre results of improperly implemented constructivist learning strategies have been noted in literature over numerous decades in various disciplines of education. For example, Wiener (1986) discussed the inappropriateness of applying collaborative instruction to the structures of traditional paradigms in English classes in the 1980s, Walker (1996) noted that instructors often implemented group work as a method of reducing their own workload when implementing cooperative learning in feminism classes in the 1990s, and Hunter (2006) examined the difficulty of assessing collaborative learning in traditional learning environments in the area of music education in 2006.

Collaborative learning that is added to a course in an ad-hoc or 'tacked on' manner is often poorly implemented and managed and rarely realises all the potential benefits of such learning strategies and the pedagogies they represent. "Whatever the form peer learning takes ... it is most successful when it is designed as an integral part of the overall course or subject" (Boud et al., 2001, p. 21). Boud, Cohen and Sampson suggest a number of design and implementation issues that should be taken into consideration in order to effectively integrate peer learning. Summarised, the design issues are:

- Consideration of the context into which peer learning is to be introduced.
- Focusing on the goals and learning outcomes.
- Ensuring that peer learning strategies are congruent with assessment tasks.
- Consideration of the resources needed to implement peer learning.

These issues relate back to the tenets of constructivism presented in Table 2.1. The implementation issues involve the preparation, introduction, management, support and evaluation of the peer learning process. Whether designing a new course or integrating peer learning into an existing one, such issues of design and implementation should be considered if the potential benefits of constructivist-based learning strategies are to be realised. Assessment is an issue of particular importance in collaborative learning, as it presents unique challenges and differences compared to the individualistic forms of assessment used in traditional education methods (Barfield, 2003; Hunter, 2006; Macdonald, 2003; Swan, Shen, & Hiltz, 2006).

Failure to address the design and implementation issues of collaborative learning is likely to result in students who “become confused, uncertain about how to proceed, and feel unsupported and sceptical about the value of what they are doing” (Boud et al., 2001, p. 23). The implementation issues of collaborative learning, in particular the provision of appropriate support by an instructor, are recognised by Colbeck, Campbell and Bjorklund (2000). They discuss the importance of collaborative learning in higher education, stating “The conditions for group learning in higher education settings rarely meet the standards advocated by cooperative learning scholars .... Many well-intentioned faculty assign group projects without providing students the information and guidance prescribed by cooperative learning advocates” (p. 61). Students who are apprehensive towards or hold a predisposed dislike of group-based work represent a trend commonly observed in both anecdotal evidence by educational practitioners and within the literature (Barfield, 2003; Monk-Turner & Payne, 2005; Payne & Monk-Turner, 2006; Volet & Mansfield, 2006; Wulf, 2005). Factors such as unequal participation of group members, logistical and communicative difficulties, and an adversity towards reliance on others are commonly cited as reasons for negative responses to group-based work. The potential for and impact of such factors can be minimised when collaborative learning is well designed and integrated into a course:

When the peer learning activity is designed so that the guidelines are clear, the purpose relates to students' needs, the practice is linked appropriately to the assessment process and the learning outcomes, and students are prepared for the experience, students can benefit from the positive features of peer learning. (Boud et al., 2001, p. 23)

When integrated into learning in a pedagogically sound manner, collaborative learning has been favourably compared to traditional instructor-centric pedagogies in numerous pieces of literature. For example, a study by Gokhale (1995) found that students performed significantly better in critical thinking tests when engaged in collaborative learning, compared to those learning individually. Gokhale cites Vygotsky (1978), Bruner (1985) and Johnson and Johnson (1986) as the guiding theories and works of her study and findings. Anderson, Mitchell and Osgood (2006) compared the outcomes of problem-based cooperative learning to traditional lecture-based classes. They found that students engaged in problem-based cooperative learning performed at a higher level in standardised testing of content knowledge, critical thinking and problem-solving tasks, and were also more positive about their learning experience. The outcomes of classes based upon Johnson and Johnson's cooperative learning theories have been evaluated in numerous studies, finding that well-implemented cooperative learning typically results in better outcomes than those of traditional education methods (Cavalier & Klein, 1998; Johnson, Johnson, & Smith, 1998b; Johnson et al., 2000; Panitz, 1997). Cooperative learning is implemented at all levels of education, so while not all evaluations have direct relevance to higher education, outcomes have been consistently positive for learners in both the development of course knowledge and interpersonal skills. Collaborative learning and other learning strategies which emphasise the collaborative aspects of constructivism have been thoroughly recognised in educational literature as effective methods of promoting deep and active learning, and developing the interpersonal skills required in the workplace (Barfield, 2003; Bruckman, 2006; Dewey, 1916; Dochy et al., 1999; Francescato et al., 2006; Huang, 2002; Monk-Turner & Payne, 2005; Slavin, 1991, 1996; Tribe, 1994; J. M. Wilson, Goodman, & Cronin, 2007).



In an empirical study of group performance in information systems project groups, Bahli and Büyükkurt (2005) identify a number of constructs which were posited to have an impact on group performance. Drawn from the literature, the constructs were identified as team building, task cohesion and social cohesion. The study found that while team building had a positive impact on task and social cohesion, it had no direct significant impact on group performance. Social cohesion, summarised as “partying together and socialising amongst group members”, was also not found to have a significant impact on group performance (p. 109). Task cohesion, summarised as the group’s dedication and focus on achieving its goals, did have a significant impact on group performance. This study supports the findings of Yoo and Alavi (2001), who also found that task cohesion and participation have a greater impact on performance than social cohesion in online collaborative environments. These and other pieces of research (see for example, Barfield, 2003; Colbeck et al., 2000; Volet & Mansfield, 2006; S. Wang, Hwang, Chu, & Tsai, 2009) have established the importance of constructivist-based collaborative learning and the particular importance of task cohesion in meeting educational and project outcomes.

The importance of group work and collaboration has been well recognised outside the domain of educational literature. One example is Cohen and Bailey (1997), who present a review of research concerning various types of teams in enterprise. The undeniable place and prevalence of group or team-based work in enterprise environments is described and linked to the growing emphasis upon collaborative work and the development of interpersonal skills in higher education. Cohen and Bailey find that self-directed and highly cohesive teams are more likely to achieve better project outcomes. Team members were found to rate their team’s performance highly based on the internal processes of the team, particularly those of collaboration and conflict resolution. While somewhat dated, the findings of Cohen and Bailey (1997) are still relevant to today’s enterprise environments. They also illustrate the relevance of well-implemented collaborative learning in educational environments to the needs of enterprise environments.

It may be noted that much of the literature cited in this section is dated, being predominantly from the 1990s. While research about collaborative learning has by no means ceased since then, the large majority of it has concerned collaborative learning within online or computer-supported environments and falls into an area known as Computer Supported Collaborative Learning (CSCL). This is of direct relevance to the current research and hence discussion of CSCL is presented in the subsequent section. In discussing the use of information and communication technologies (ICTs) to enhance learning from a pedagogical perspective, Wang (2008, p. 103) makes a statement which effectively summarises the topics addressed in this section and introduces those of the next:

Educators have been rethinking pedagogy and reflecting on new methods to help tertiary institutions produce marketable graduates. Problem-based and learner-focused educational models are beginning to flourish, and educators are implementing new curricular tools that focus on shifting from teacher-centered, traditional classroom teaching environments to student-focused and problem-based learning enhanced with ICTs.

## ***2.2 Online Education and Groupware***

This section of the literature review examines the evolution of online education, and the software utilised to support collaborative learning in modern online environments. Online education, or e-learning, initially emerged as an extension of distance education – using the Internet as a means to deliver course content in an off-campus mode. Structured primarily around the generations of e-learning presented by Connolly and Stansfield (2006, pp. 462-464; 2007a, pp. 20-22), Section 2.2.1 presents an overview of the evolution of e-learning, pedagogical and technological influences, and an examination of the importance of collaborative learning in online education.

Following on from this, Section 2.2.2 focuses upon groupware. Groupware is software that supports group-based collaborative work, and is a major component of modern online education. This section of the literature review had a direct influence upon this research, which involved the development of a groupware application (detailed in Section 3.6) in order to test and refine a model of participation awareness.

## 2.2.1 The Evolution of e-Learning

The traditional context of learning is experiencing a radical change. People change careers and relocate several times throughout their lives. The concept of traditional education does not fit well with the new world of lifelong learning, in which the roles of instructor, students, and curriculum are changing. (Zhang & Nunamaker, 2003, p. 207)

Following the development and proliferation of the Internet and personal computers in the 1990s, higher education facilities began to experiment with online education or 'e-learning'. Where distance education had previously been delivered via posted or broadcasted materials, it could now be placed online where it was available to distance learners at any time or place. By delivering distance education through the medium of the Internet, the efficiency and effectiveness of updating course content and communicating with distance learners increased, and online delivery was soon adopted not only for distance education, but also to supplement campus-based courses (Barab et al., 2001; Bernard et al., 2004; Desjardins & van Oostveen, 2008; Stahl et al., 2006).

The adoption of online content delivery to supplement education outside of distance education is often linked to the concept of flexible learning (Bates, 2005; Collis & Moonen, 2001; Moran & Myringer, 1999; Rowntree, 2005). Flexible learning takes the "geographical, social and time constraints of individual learners" (Bates, 2005, p. 5) into account. Numerous techniques are employed by educational facilities to implement flexibility, including the provision of face-to-face courses after working hours, on weekends, and outside traditional times of the year. Offering online modes of study is another technique by which educational facilities are able to make their courses more accessible. Moran and Myringer (1999, p. 58) describe the changing demographics of students as one of the triggers for a shift towards flexible learning. "Rigid times and places of formal teaching do not suit the requirements of many potential learners who must juggle study with work and family commitments and may be some distance from a campus." Flexible learning can be perceived as a more modern and wide ranging concept than that of distance education, as it encapsulates the geographical constraints of learners as well as those of time and other obligations. Since the 1990s both concepts have been heavily influenced by developments in technology – particularly those of the Internet and Web-based applications.

The initial integration of the Internet into education was led by technology rather than pedagogy, in a manner recognised by Bates (2005, p. 4). “Whenever a new technology emerges in education people in general ignore what has been learned in previous contexts .... The need to reorganize and redesign teaching to exploit fully a new technology is often ignored.” Such sentiments are widely recognised in educational literature, for example by Markel (2001), who states that “the integration of technology in instruction is not an excuse to abrogate our responsibility to design stimulating courses that provide learning opportunities based on sound pedagogical principles.” The evolution of education with respects to technology and pedagogy is well illustrated in Connolly and Stansfield (2006, pp. 462-464; 2007a, pp. 20-22), who describe e-learning as being in its third generation, representing the fourth, fifth and sixth generations of distance education. Connolly and Stansfield cite Nipper (1989) and Taylor (2001) in defining and refining the distance education and e-learning generations. A summary of the generations of distance education and e-learning, drawn primarily from Connolly and Stansfield (2006), is presented in Table 2.2.

Table 2.2 – Generations of distance education e-learning

<b>Distance Education Generations (pre mid-1990s)</b>	<b>Implementation Tools &amp; Methods</b>	<b>Guiding Pedagogies &amp; Learning Strategies</b>
<b>First</b> (“Correspondence Model”)	Print-based materials via post.	Non-interactive, passive learning. Infrequent communication with instructor, and no peer interaction.
<b>Second</b> (“Multimedia Model”)	Print, audiotape, videotape and computer-based materials.	More engaging but primarily non-interactive materials. Infrequent communication with instructor, and no peer interaction
<b>Third</b> (“Telelearning Model”)	Two way audio and video based teleconferencing and broadcasting.	Interactive, and synchronous communication with instructor. Instructor-centric pedagogy, with little peer interaction/collaboration.
<b>e-Learning Generations (post mid-1990s)</b>	<b>Implementation Tools &amp; Methods</b>	<b>Guiding Pedagogies &amp; Learning Strategies</b>
<b>First</b> (“Objectivist e-Learning”)	Transcribe existing course material into online format. Basic use of e-mail and some use of low-fidelity audio and video.	Traditional instructor-centric, individual and passive learning. Pre-Internet philosophies/pedagogies.
<b>Second</b> (“Flexible e-Learning”)	OLEs incorporate course material and communication tools. High-fidelity audio and video, and more use of asynchronous communication.	Some asynchronous communication between learners, resulting in more active and peer-based learning.
<b>Third</b> (“Constructivist e-Learning”)	Collaborative learning environments emerge, focusing on interactivity and learner interaction. Mobile learning begins to emerge, via PDAs/phones.	High degree of collaboration and interaction between learners supports constructivism. Learning is active, reflective and engaging.

The generations of distance education emerged with the availability and viability of advances in technology, aiming to provide distance learners with materials that were richer, more engaging, and more interactive than printed materials (Nipper, 1989). It is worth noting that while the third distance education generation, the telelearning model, presented an increase in interactivity and communication between learners and instructors, it came at the expense of the 'anywhere, anytime' ideal of distance education. In order to participate, learners were required to be available in areas with access to appropriate technology at specific times, requirements that seem to be adverse to the ideals of distance education and flexible learning.

The e-learning generations described in Table 2.2 illustrate the technology-driven evolution of online education well and outline the transition from simply providing traditional education in an online environment, towards developing online education that makes the most of Internet-based delivery and incorporates active, collaborative learning based upon constructivist theories (Govindasamy, 2001; Hamid, 2001; Stahl et al., 2006). Connolly and Stansfield (2007a, p. 20) describe the first generation of e-learning as "mainly passive use of the Internet ... primarily consisting of repurposing of course material to an online format." Educational materials consisted largely of text on static Web sites, supplemented by some multimedia elements – the size, amount and quality of which were limited by the technology and bandwidth of the time. First generation e-learning largely failed to take advantage of the 'hypermedia' format of the Internet, which allows a wide range of resources to be structured and connected in a way that encourages browsing and exploration – a property that has been found to support active, learner-centric education (Alavi, 1994; Becker & Dwyer, 1994; Desjardins & van Oostveen, 2008; Graff, 2003; Oliver, Herrington, & Omari, 1996; Stahl et al., 2006). This generation of e-learning essentially reproduced traditional educational methods, as described in Section 2.1.1, in an online environment. While e-mail was utilised for basic mentoring and communication between learners and instructors, the immediacy afforded by face-to-face education methods was not possible. In terms of interactivity, active learning and immediacy of communication, the first generation of e-learning can be seen as a step back from the third generation of distance education.

The second generation of e-learning saw the evolution of more sophisticated online course content delivery software, described under several names including Asynchronous Learning Networks (ALNs), Web-Based Learning Environments (WBLEs), Course Management Systems (CMSs) and Learning Management Systems (LMSs). This thesis will refer to such software as Online Learning Environments (OLEs), a generic name frequently used in the literature. As Internet technology became more advanced and widely adopted, users of OLEs were able to take better advantage of the online environment (M. S. Cohen & Ellis, 2002; Connolly & Stansfield, 2006, 2007a, 2007b; Francescato et al., 2006; Griffin, 2001; Taylor, 2001). A wide range of more refined resources became available on the World Wide Web, able to be integrated into e-learning materials, while greater bandwidth led to an increased usage of multimedia. The richness of educational materials rose, commonly making use of slideshows, animations, quizzes and other interactive elements. Unlike the static Web sites of the first e-learning generation, the OLEs of the second generation implemented more than course materials (A. Brown, 1997; R. C. Clark & Mayer, 2008; M. S. Cohen & Ellis, 2002; Godwin-Jones, 2003; Rich et al., 2009; Robbins, 2002; Salmon, 2006; Woo & Reeves, 2008). Communication tools were made available, primarily in the form of asynchronous discussion forums and chat rooms that allowed learners to communicate with instructors and their peers. OLEs began to incorporate and integrate various student services, including the delivery and submission of assessments. Figure 2.1 presents a screenshot of an early OLE named "HyperCourseware" (Norman, 1994a, 1994b). Originally available over a local network and later online via the Web, HyperCourseware provided hyperlinked course content and rudimentary support for a number of other features including asynchronous and synchronous communication, assessment, and collaboration. Despite its emergence in the mid 1990s, a timeframe associated with the first generation of e-learning, HyperCourseware embodies many of the facets of second generation OLEs, albeit in a more basic form and without the associated richness of materials.

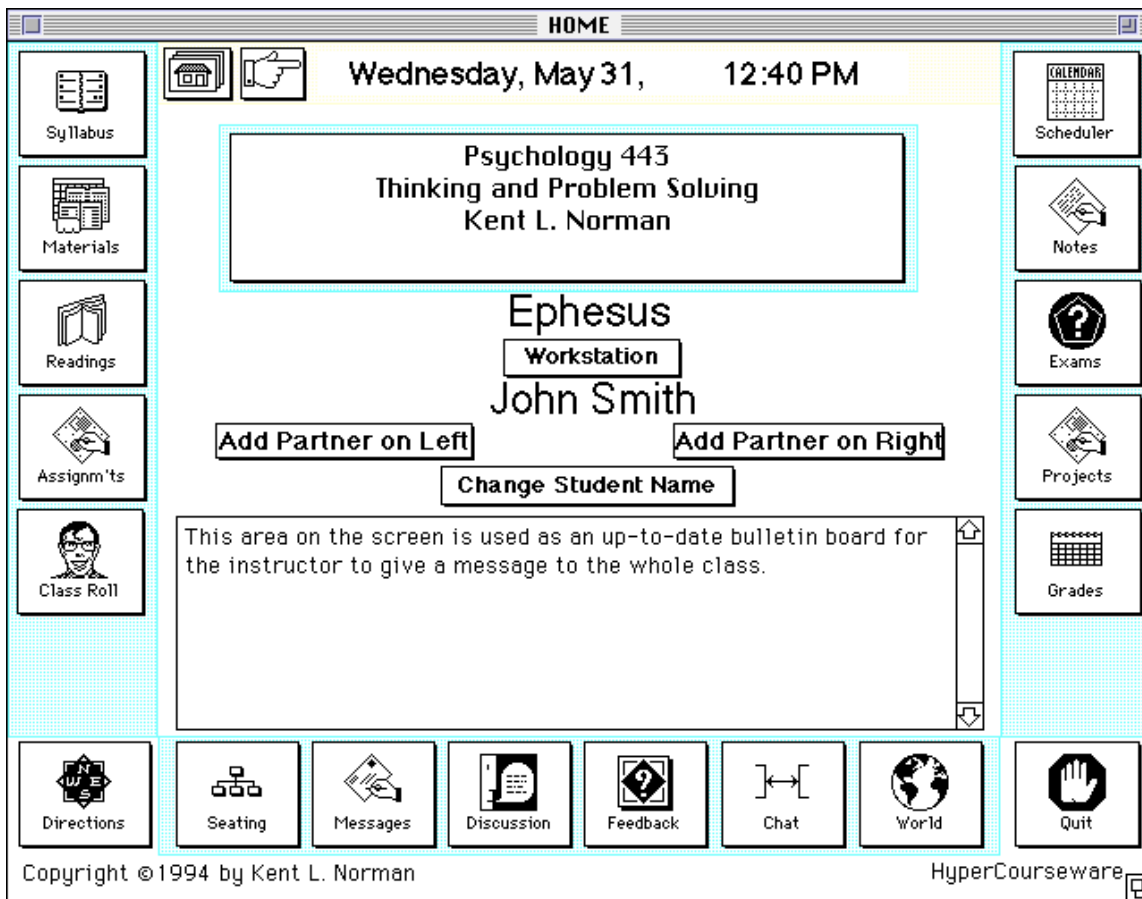


Figure 2.1 – Screenshot of HyperCourseware, an early OLE

While advances in the second generation of e-learning were again guided largely by developments and adoption of new or improved technologies, they were also able to strengthen the pedagogical foundations of e-learning. Materials were developed to capitalise on the electronic and online environment, resulting in course content that was more interactive and engaging, encouraging active learning. Encouraging peer communication via asynchronous discussion forums “support[s] a constructivist form of learning [and] encourages more reflection and disciplined and rigorous thinking” (Connolly & Stansfield, 2007a, p. 20) – an effect recognised in numerous pieces of literature (Cain & Pitre, 2008; R. C. Clark & Mayer, 2008; Francescato et al., 2006; Garrison & Anderson, 2003; Garrison, Anderson, & Archer, 1999; Griffin, 2001; Hooper, 1992; Robbins, 2002; Salmon, 2006; Salmon & Giles, 1998; Woo & Reeves, 2008).

If online learning is to rise to the level of its promise, it is necessary to create a pedagogical model or models that enable educators to capitalize on the potentials afforded by online learning technologies (Norton & Hathaway, 2008, p. 476)

The third and current generation of e-learning is particularly significant in that it has been guided by pedagogy, rather than technology. Dubbed “constructivist e-learning” (Connolly & Stansfield, 2007a), the current generation of e-learning emphasises the importance of core constructivist tenets such as active, learner-centred and problem-based learning, with a high degree of interaction and collaboration amongst peers. An increasing number of courses delivered or supported via e-learning are being designed to integrate group-based tasks and discussion, encouraging peer interaction and active learning (Barab et al., 2001; Francescato et al., 2006; Govindasamy, 2001; Hao, 2004; Harasim, 1999; Lehtinen et al., 1999; Mayadas, Bourne, & Bacsich, 2009; Rich et al., 2009; Santoro, Borges, & Santos, 1999; Woo & Reeves, 2008). The nature of such tasks is varied, including full class or small group discussions, group-based case study analysis and prolonged small group collaboration on a project (J. Clark, 2000; McConnell, 2000; Tam & Greenberg, 2006; T. J. Wang, 2008). Such activities implement collaborative and constructivist-based learning and illustrate the way in which the changing pedagogy of face-to-face education (outlined in Section 2.1.1) has influenced the evolution of modern e-learning. This is recognised by Hao (2004, p. 21):

Collaborative interaction occurs when learners are discussing issues on a bulletin board or solving problems by working together, for example, discussion activities, sharing of ideas and information, or working as a team. .... Through the process of discussing and interacting with other learners and the instructors, the learner constructs new knowledge.

The concept of the ‘virtual classroom’ has also been refined and seen wider successful adoption in this generation of e-learning. Virtual classrooms provide a Web-based analogy of a face-to-face classroom, typically in the form of a synchronous environment where learners and instructors are able to communicate and interact in real time (R. C. Clark & Kwinn, 2007; Hiltz, 2006; Palloff & Pratt, 2007; Rich et al., 2009; Yang & Liu, 2007). While communication is predominantly text-based, the increasing availability of high-speed Internet connections has led to the increased use of audio and video communications. The instructor in a virtual classroom is able to moderate and guide the class, presenting resources such as slideshows, images and videos inside the online environment. A ‘whiteboard’ is commonly implemented, providing an area in which instructors and learners can draw or write. Such tools facilitate activities like



brainstorming, the illustration of points, and the creation of diagrams. Figure 2.2 presents a screenshot of “eLecta Live” (eLecta Communications Ltd., 2010), a modern virtual classroom application that implements the features described above.

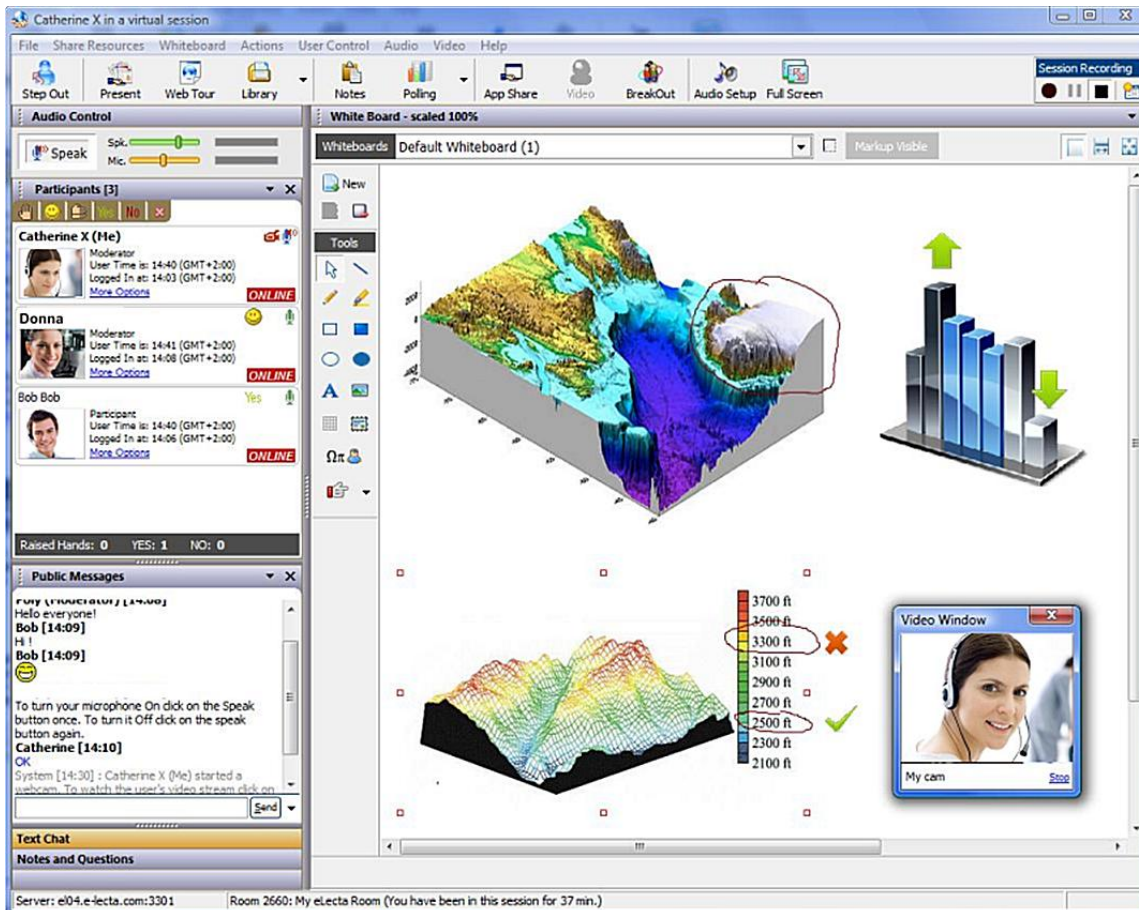


Figure 2.2 – Screenshot of eLecta Live, a modern virtual classroom application

Although virtual classrooms represent a departure from the time-independent nature of the asynchronous learning environments which remain the mainstay of e-learning, they have been found to be effective in numerous educational contexts, helping learners to feel like “members of a learning society” (Zhang & Nunamaker, 2003, p. 209). Asynchronous interaction remains predominant in both class-based e-learning and within individual groups of learners engaged in collaborative projects in online environments. As virtual classrooms have illustrated, synchronous interaction can be an effective way to support class-based e-learning. The importance of including some form of synchronous interaction in primarily asynchronous small group collaboration environments has also been recognised in the literature (Hao, 2004; McConnell, 2000; Stacey, 2000; Steinfield et al., 1999; S. Wang et al., 2009).

The concept of synchronous virtual classrooms is not new, having existed in numerous forms since the inception of e-learning (Bilotta, Fiorito, Iovane, & Pantano, 1995; Turoff, 1995). However, widespread adoption was quite limited until the technology to implement them effectively became widely available. Hence, while advances in Internet-based technologies are without doubt a major facilitator of virtual classrooms, their implementation in modern times has been guided by pedagogical ideals, rather than technological opportunism (R. C. Clark & Kwinn, 2007; Palloff & Pratt, 2007). Even in early literature regarding virtual classrooms, the importance of active and collaborative learning is recognised – “The objectives of a Virtual Classroom are to improve ... the quality and effectiveness of education by using the computer to support a collaborative learning process” (Turoff, 1995, p. 219).

A parallel exists between the integration of collaborative learning strategies in online education and in traditional face-to-face education, as discussed in Section 2.1.2. For the potential benefits of such strategies to be realised, their integration into any course, online or otherwise, must be based on sound pedagogical practices, rather than as additional elements to traditional instructor-centric environments. The third generation of e-learning recognises the importance of this fact. Hence, the design of modern OLEs builds upon the developments that emerged in the second e-learning generation in order to enhance the pedagogical foundations of online education. Asynchronous and synchronous interaction between learners and with instructors is emphasised, allowing for active reflection upon course content and the social construction of knowledge (Baatard, 2006; Bruckman, 2006; Garrison & Anderson, 2003; Garrison et al., 1999; Hao, 2004; Hiltz et al., 2000; Huang, 2002; Palloff & Pratt, 1999; Salmon, 2006; Stahl et al., 2006; Woo & Reeves, 2008). Such features encourage learners to make their thoughts and ideas public in an active manner, providing “opportunities for them to build and refine meanings based on their own experience and that of their peers” (Barab et al., 2001, p. 109).

In recent years, OLEs have adopted and integrated modern online communicative and collaborative technologies and platforms such as wikis, blogs, and social networking in order to further engage learners (Boulos, Maramba, & Wheeler, 2006; R. C. Clark & Mayer, 2008; Fichter, 2005; Godwin-Jones, 2003; Rich et al., 2009; Usluel & Mazman,

2009; Wheeler, Yeomans, & Wheeler, 2008). While such technologies have existed for a number of years, their use in education is not yet widespread and hence a historical evaluation of their impact on online education is not available. Emerging research has reported the adoption of wikis, blogs and other platforms in educational programs can lead to positive educational outcomes and increased learner satisfaction. The inclusion of collaborative learning and constructivist-based learning strategies is cited as essential to the effectiveness of such programs (Rich et al., 2009; Usluel & Mazman, 2009; Wheeler et al., 2008). Some potential disadvantages and negative impacts of tools such as wikis have also been noted in these, and other, studies. Foremost amongst these are the risks of wikis being 'vandalised' (a consequence of a system which allows anybody to edit anything) or becoming unorganised. The risk of contributors becoming possessive or defensive of their contributions, resulting in individualistic competitiveness, has also been identified as a potential disadvantage. Careful moderation and an emphasis on collaborative learning and assessment have been proposed as methods of minimising the potential disadvantages of these tools (Boulos et al., 2006; Wheeler et al., 2008). Features such as wikis, blogs and podcasting are supported in "Blackboard Learn" (Blackboard Inc., 2010) the current version of the well-known Blackboard OLE – shown in Figure 2.3.

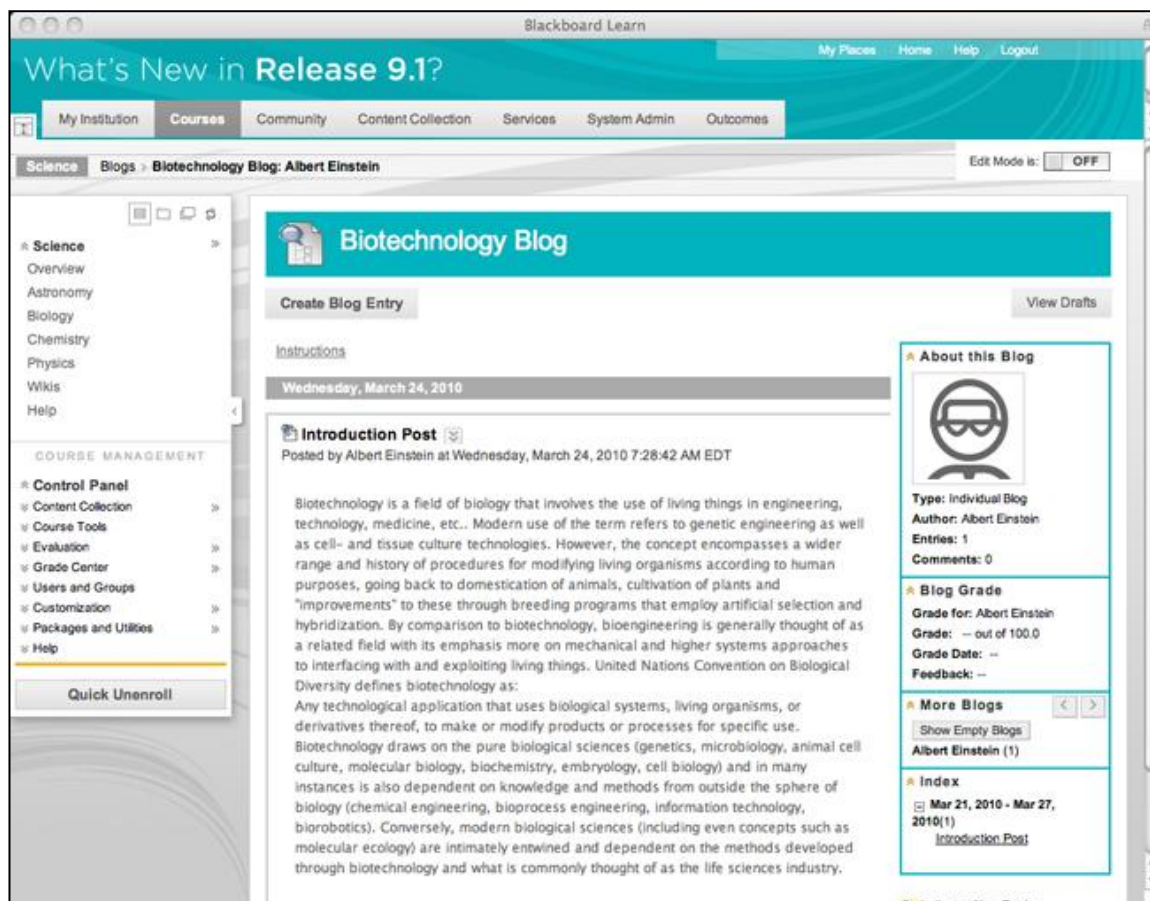


Figure 2.3 – Screenshot of a blog in Blackboard Learn – a modern OLE

A final element of note in the third generation of e-learning is mobile learning, or ‘m-learning’, which aims to integrate wireless tools such as mobile phones and PDAs into the learning process, allowing for location-independent learning opportunities (B. Alexander, 2004; Chao & Chen, 2009; Kukulska-Hulme & Traxler, 2005; López, Royo, Laborda, & Calvo, 2009; Motiwalla, 2007). Mobile learning is very much in its infancy, however as the adoption of mobile devices with strong multimedia and collaborative capabilities increases and high-speed data-enabled wireless networks become more widespread, it is a concept with great potential.

It is worth reiterating that regardless of the technology available to support online collaboration and interaction, courses must be designed in ways which encourage learners to actively engage in collaborative learning. Simply having tools and facilities for collaboration available in an online environment will not ensure that they are used appropriately or at all (Brazelton & Gorry, 2003; Francescato et al., 2006; Markel, 2001). Online course design based on the ideals of constructivism and collaborative

learning also help to address issues which arise from the nature of online or distance education – minimising the potential for decreased motivation and feelings of isolation often experienced by online and distance learners. An emphasis on collaborative learning in online education leads to greater course satisfaction, better educational outcomes, and lower rates of attrition (Bruckman, 2006; Hao, 2004; S. C. Hughes et al., 2002; Mayadas et al., 2009; McConnell, 2000; Norton & Hathaway, 2008; Stacey, 2000).

Having outlined the evolution of distance education and e-learning and the emergence of constructivist-based pedagogy over technology as a guiding force, the conclusion of this section will focus on the area of highest relevance to this research – that of collaborative learning in online education. There has been extensive research regarding the implementation and impact of collaborative learning in online education, the area of literature commonly known as Computer Supported Collaborative Learning (CSCL). Francescato et al. (2006, p. 165) describe the theories and concepts upon which CSCL is based:

[CSCL] brings together the theoretical contributions of collaborative learning models and the capabilities of online learning platforms. This approach has attracted the attention of many experts in different disciplines, primarily because it allows computer-supported education to go beyond individually centered learning, promoting collaborative or group learning.

As one of the core principles of constructivism, the importance of collaboration in computer-supported and online education has long been recognised in the literature. Brown (1997, p. 125) states that “collaborative learning by means of the new computer mediated communications systems can extend and support active, purposeful learning.” A holistic study by Barab, Thomas and Merrill (2001) found that learners participating in an online course focused on collaboration through discussion forums did indeed experience deep and meaningful active learning. A focus on collaborative learning in online education has largely emerged in the third generation of e-learning, where it has become recognised as an extremely important component in the design of online courses (Desjardins & van Oostveen, 2008; Haythornthwaite, 2006; Mayadas et al., 2009; McConnell, 2000; Rich et al., 2009; Stahl et al., 2006; Woo & Reeves, 2008).

Research has found that the educational outcomes of online learning can equal or even exceed those of face-to-face learning, with collaborative learning acting as a key factor (Hao, 2004). An early empirical study by Scott et al. (1997, p. 251) found that “virtual teams can produce good output and that in the eyes of many of the respondent students, virtual teams can operate as successfully as face to face teams.” Later research by Hiltz, Coppola, Rotter and Turoff (2000, p. 120) found that:

When students are actively involved in collaborative (group) learning on-line, the outcomes can be as good as or better than those for traditional classes, but when individuals are simply receiving posted material and sending back individual work, the results are poorer than in traditional classrooms.

Another study by Francescato et al. (2006) found correlating results. Comparing online and face-to-face collaborative learning, it was found that “the online students did as well as the face-to-face students in terms of both perceived and actual learning (increase in knowledge)” and that the online students “appeared to be more efficient in working together” (p. 172). Similar findings have been reported in numerous studies in the literature (see for example, Bahli & Büyükkurt, 2005; Cain & Pitre, 2008; J. Clark, 2000; M. S. Cohen & Ellis, 2002; Curtis & Lawson, 2001; Hooper, 1992; Larson & Sung, 2009; Mayadas et al., 2009; Oliver, 2001; Stacey, 2000). These studies highlight the importance of collaborative learning to the effectiveness of online education. A quote from Zhang and Nunamaker (2003, p. 213) summarises this area of the literature effectively:

Substantial research has shown that groupware supported collaborative learning leads to better student involvement, better performance, and higher participation and productivity than individual learning.

### **2.2.2 Groupware**

As collaborative or group-based tasks become increasingly prominent and complex in online learning, the software required to facilitate them effectively requires an increasing level of sophistication. For example, while group discussion can be supported by a chat room or asynchronous discussion forum, the production of a lengthy document such as a project plan by a small group of learners is a commonly

encountered collaborative learning scenario in both face-to-face and online education (Boud et al., 2001). Such a task requires a more sophisticated tool or application than a chat room or discussion forum to support it in an effective manner. To provide appropriate support for such a task, an application is needed that provides centralised document management, communication facilities, and other facilities like calendaring to support coordination and collaboration. As discussed in Section 2.2.1, modern OLEs typically implement numerous collaboration and communication tools, both synchronous and asynchronous, such as virtual classrooms and discussion forums. These tools are not always appropriate to support prolonged group work, often being transitive, in the case of virtual classrooms, or tailored towards all learners in a course, rather than small groups. Figure 2.4 illustrates the group support tools of Blackboard Learn (Blackboard Inc., 2010).

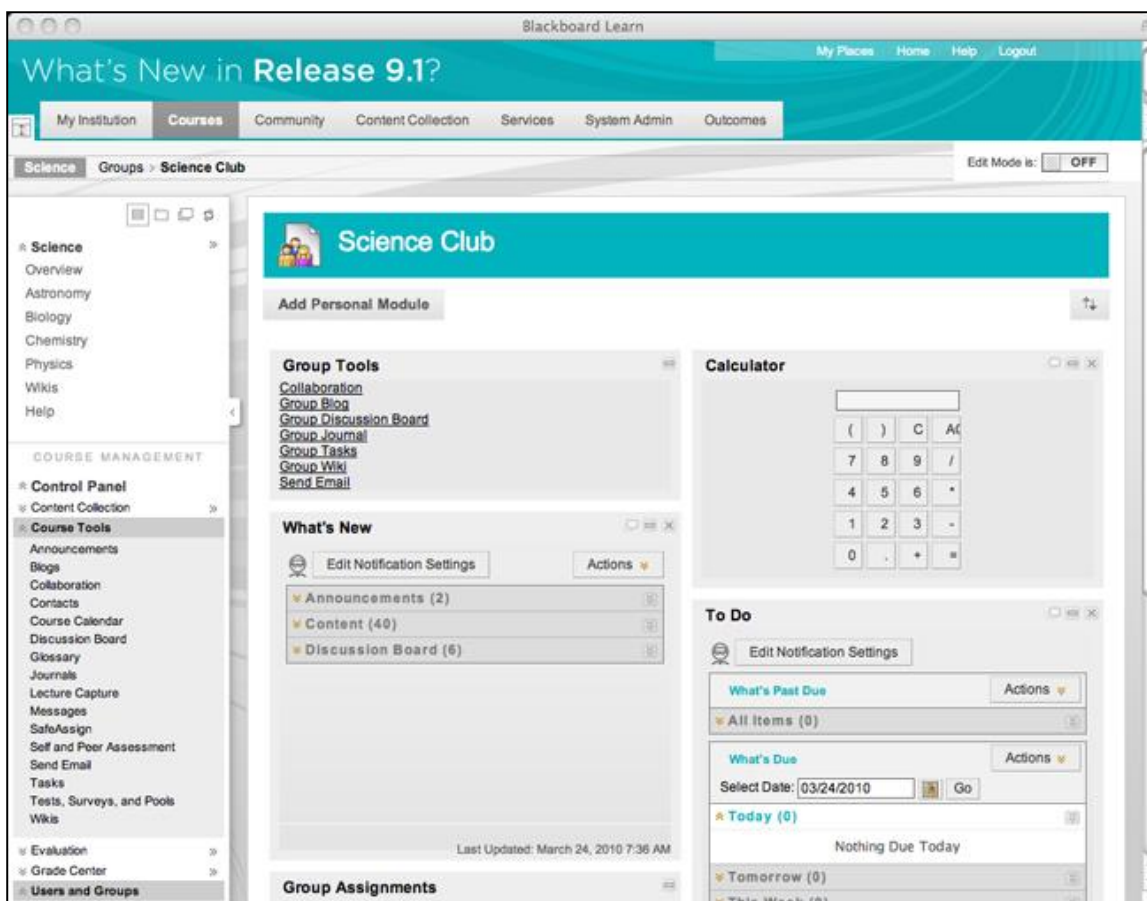


Figure 2.4 – Tools supporting prolonged group work in Blackboard Learn

In order to provide the sophisticated environment required to complete complex or prolonged collaborative tasks, software known as groupware is often employed

(Grudin & Poltrock, 1997; Lehtinen et al., 1999; Whatley, 2004). Groupware comes in two main forms, primarily defined by the manner in which it is implemented and the context in which it is used. Regardless of the form groupware takes, its purpose is always to provide an environment which provides the collaboration, communication and coordination support required to conduct group work. It is worthwhile to mention at this stage that the definition of groupware varies in both the literature and common usage. Some definitions of groupware encompass any software or technology that can be used to support group work such as e-mail, instant messaging and discussion forums. Although designed to support communication, these tools *can* be used to support prolonged group work, albeit with less sophistication than software designed for the purpose. This thesis uses the term groupware to refer only to software which is designed to support collaboration or group-based work, including both standalone applications and group support tools incorporated into environments such as OLEs.

The first form of groupware to be discussed is typically used to support collaborative group work in enterprise, an area of literature commonly known as Computer-Supported Cooperative/Collaborative Work (CSCW). While sharing many fundamental tenets, CSCW is differentiated from CSCL by its focus on enterprise rather than educational contexts, and related issues such as project outcomes rather than educational outcomes (Lehtinen et al., 1999). Groupware in enterprise often requires substantial infrastructure support, with file and database servers, middleware and local application software needing to be deployed throughout an organisation – however much of this can be offset via external hosting of the application (Baatard, 2006, p. 24). Prominent examples of these systems are Lotus Notes and Microsoft Exchange. Such systems provide a persistent environment to meet the collaborative and communicative needs of an organisation, with features ranging from e-mail management, discussion forums and instant messaging, to document co-authoring, version control and workflow management (IBM, 2005; Lehtinen et al., 1999; Mittman & Jackson, 2001). The adoption and effectiveness of enterprise-oriented groupware has been linked to a number of factors including organisational culture, the perceived need for sophisticated collaborative environments, and whether the groupware environment is able to model the workflow of an organisation (Grudin & Poltrock,



1997; Lehtinen et al., 1999; Olson & Olson, 2009; Riemer, Steinfield, & Vogel, 2009; Vandenbosch & Ginzberg, 1997).

The second form of groupware is that which is deployed in a Web-based manner, requiring only a Web browser to access. Local software support is not required, and the groupware application is often hosted remotely, thus removing the need for infrastructure support. This form of groupware is often focused on a specific collaborative task, such as authoring a document or building a Web site, however some systems such as Basic Support for Collaborative Work (BSCW) provide a generic collaborative environment (Appelt & Birlinghoven, 2001; Fraunhofer Institute for Applied Information Technology, 2005; Mittman & Jackson, 2001). Figure 2.5 shows the main interface of BSCW, illustrating some of the functionality provided by a wholly online groupware system.

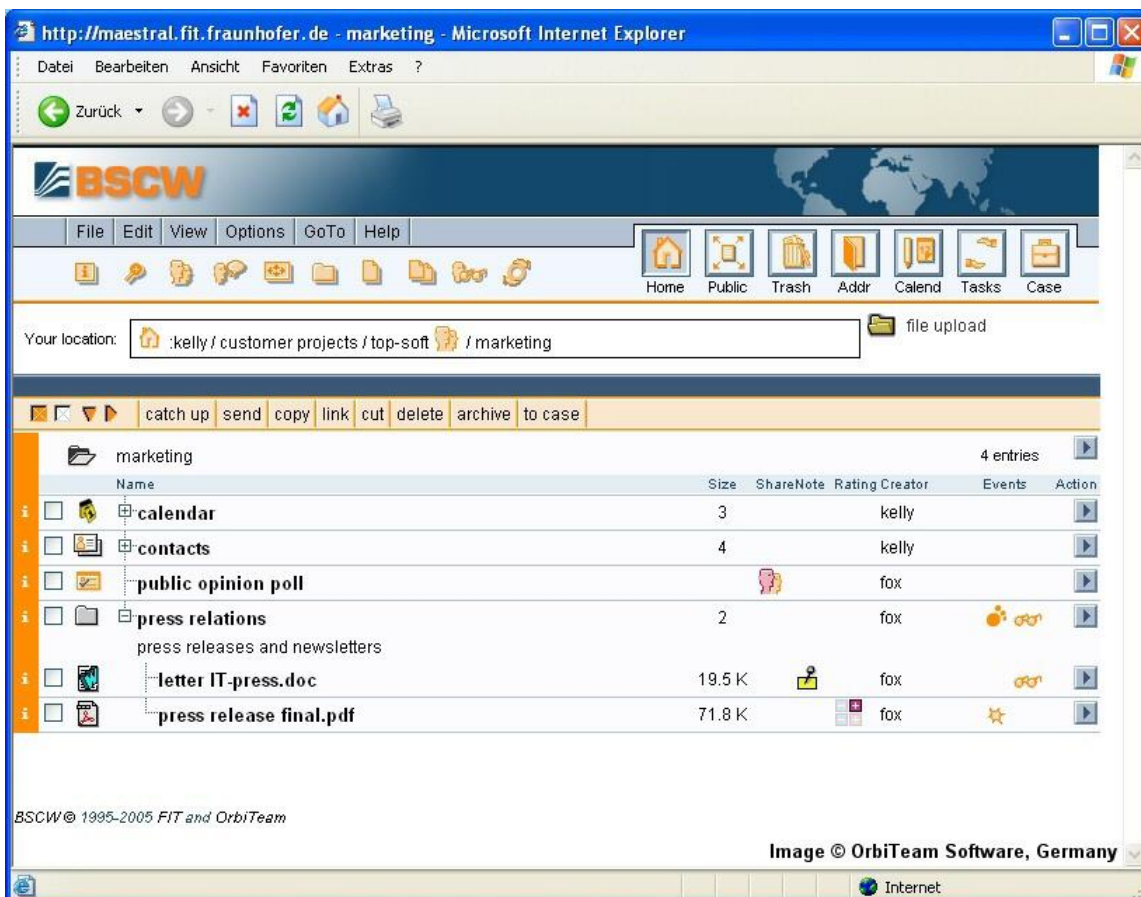


Figure 2.5 – Screenshot of BSCW, an online groupware system

While wholly online groupware typically lacks some of the sophistication and local system integration available in enterprise groupware, it provides an online environment accessible anywhere and anytime, which is often platform independent and available for little or no cost (Mittman & Jackson, 2001). These attributes make this type of groupware an appealing and appropriate choice for groups of learners striving to complete a collaborative task. This form of groupware is often employed by groups of learners in both online and traditional face-to-face courses as it offers an effective means of content distribution, communication and collaboration that is available at all times. While both forms of groupware are relevant to this research and a participation awareness mechanism could be implemented in either form, the groupware application used in this research is of the Web-based variety, as it best suits the higher education context. It must also be mentioned that the two forms of groupware described are by no means rigidly defined or mutually exclusive. For example, products such as activeCollab (a51 d.o.o. Ltd., 2010), shown in Figure 2.6, provide enterprise-oriented groupware which is wholly online.

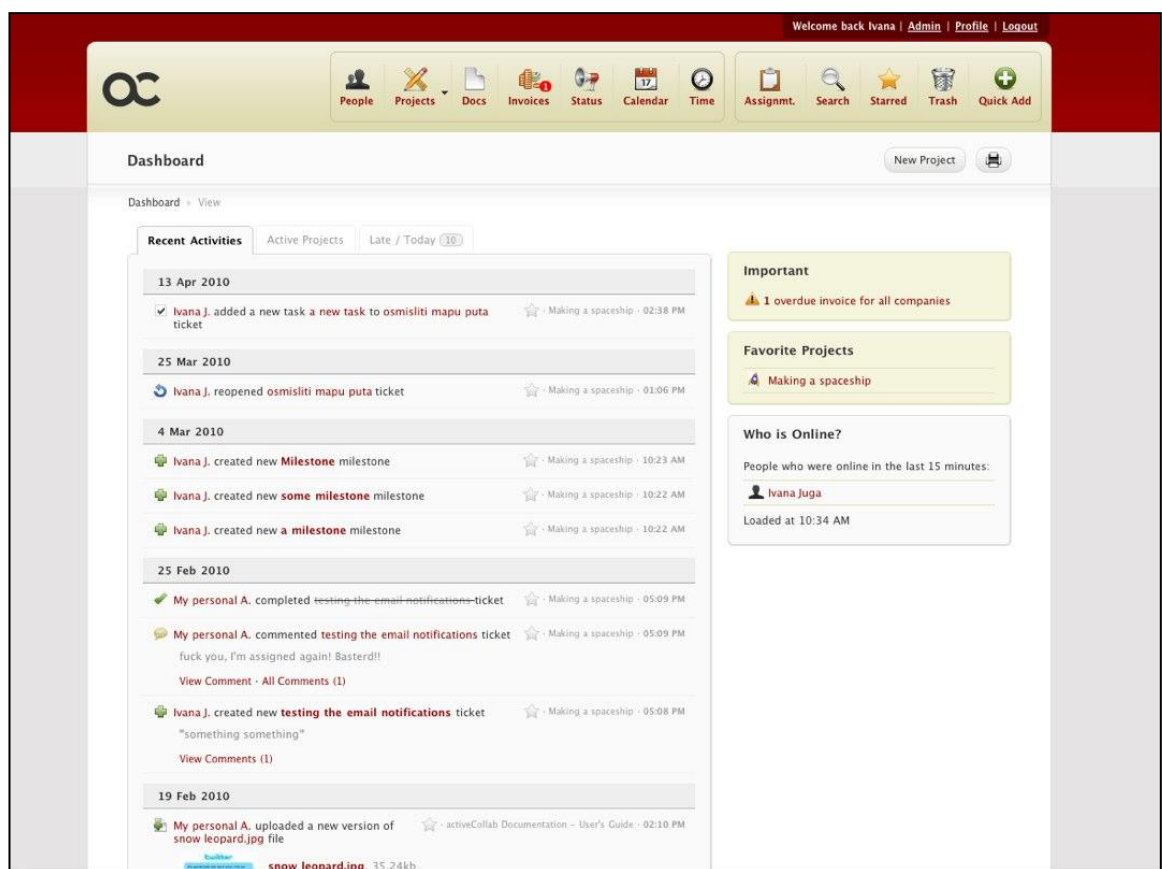


Figure 2.6 – Screenshot of activeCollab, an enterprise-oriented online groupware system

During the last ten years the sophistication of Web-based groupware has risen dramatically. This has been facilitated by the increasing availability of high-speed Internet connections and development of Web-based technologies, which has resulted in a diminishing of the distinction between local application software and Web-based applications. Enterprise-oriented groupware systems such as Microsoft SharePoint now offer Web-based collaborative environments (Microsoft Online Services, 2009; Zhu, 2001). The interface design of Web-based applications and groupware has been the topic of substantial research (Haake, Ochoa, & Cechich, 2007; Wroblewski & Ramirez, 2005; Zhu, 2001). Amongst these, Wroblewski and Rantanen (2001) present a number of guidelines for the design of Web-based applications. These guidelines are primarily concerned with making effective use of the Web browser environment and the utilisation of visual elements which are both internally consistent and consistent with those used in other applications and on the WWW. The overarching ideal of Web-based application and groupware design is to provide an interface which maximises the Web-based environment, while minimising the cognitive load of the application by utilising interface elements that are familiar to users. Such ideals and guidelines have been taken into consideration in the design of GroupShare, the groupware application developed for this research. The design of GroupShare is further discussed in Section 3.6.1.

The use of software to support collaboration is by no means limited to this decade or the emergence of the WWW in the mid-1990s. Prominent in research in the 1980s and early 1990s were Group Decision Support Systems (GDSSs) – task-oriented collaborative applications that support electronic meetings (Chidambaram & Bostrom, 1993; DeSanctis & Gallupe, 1987; Eden, 1992; Gray, 1987; Huber, 1984; Rao & Jarvenpaa, 1991). A GDSS typically involves a physical meeting room containing a networked computer terminal for each meeting participant and a single group display screen. Meeting participants are able to participate, communicate and share information via their terminal with a group leader, or ‘chauffeur’, directing and structuring the meeting via the group display (Gray, 1987; Huber, 1984).

A GDSS aims to improve the process of group decision making by removing common communication barriers, providing techniques for structured decision analysis, and systematically directing the pattern, timing or content of discussion. (DeSanctis & Gallupe, 1987, p. 589)

As technology developed, the scope of GDSSs evolved to incorporate audio and video conferencing over local and wide area networks, including the Internet. Research into GDSSs has found them to be an effective means of facilitating and improving the outcomes of meetings, decision making and idea generation when appropriately implemented and supported (Alavi, 1994; Benbasat & Nault, 1990; Jessup, Connolly, & Galegher, 1990; Karan, Kerr, Murthy, & Vinze, 1996; Lim, Raman, & Wei, 1994; Limayem, Banerjee, & Ma, 2006; Pervan, 1998). Similar to the findings of research on organisational groupware, GDSS effectiveness is influenced by a number of factors including organisational culture, workflow, group size and composition, and the need for technological support (Benbasat & Nault, 1990; Jessup et al., 1990; Pervan, 1998). While research continues in the area of GDSSs, the majority of research in the area now concerns CSCW groupware technologies, which have a broader scope and often integrate the tenets of GDSSs. Web-based GDSSs such as "TeamSpirit" (M. Chen, Liou, Wang, Fan, & Chi, 2007) which could be regarded as a form of specialised Web-based groupware have also been developed.

Groupware has proven to be an effective means by which to support collaboration in both educational and enterprise environments. An early example is presented in Kock Jr and McQueen (Kock Jr & McQueen, 1996), who studied the effects of an asynchronous groupware application on the outcome quality and productivity of seven process redesign groups in a higher education context. Recognising the need to employ a groupware tool that participants were familiar with, the groupware used by participants in Kock Jr and McQueen was primarily e-mail based. Despite the rudimentary nature of the groupware tool the outcomes were mainly positive, and showed a "considerable increase in group productivity, as well as a slight increase in group outcome quality" (Kock Jr & McQueen, 1996, p. 19). In Manning and Riordan (2000), students utilising an asynchronous groupware application to support collaborative learning in an economics class achieved better outcomes than those not utilising groupware. Students utilising the groupware application remained more

focused, communicated more and participated more evenly. While the findings of Manning and Riordan are based on a small sample size, they correlate with the findings of similar studies, such as Greenlaw (1999), who also investigated the impact of groupware in an economics course. Both of these studies, and others, recognise the importance of integrating technology into education based on sound pedagogical practices, as discussed in Section 2.2.1.

Studies and literature in more recent years also reports positive outcomes due to the integration of groupware in education. In Nicol and MacLeod (2005), the use of BSCW (see Figure 2.5) in an engineering design class resulted in an improved level of resource sharing and collaboration amongst learners. Baudin and Villemur (2009) utilised a synchronous groupware environment which included features similar to those of a virtual classroom to support collaborative learning in geographically dispersed groups. They found no statistically significant differences between the educational outcomes of face-to-face collaborative groups and distributed groups collaborating via the groupware environment. Hertz-Lazarowitz and Bar-Natan (2002) found that students engaged in CSCL performed slightly better than those working face-to-face. Fjermestad (2004) performed a meta-analysis of 145 collaborative learning studies in which the communication mode was the independent variable. Findings suggested that use of groupware or GDSSs “improves decision quality, depth of analysis, equality of participation, and satisfaction over manual methods” (p. 239). Both of these studies echo the findings of research such as Hiltz, Coppola, Rotter and Turoff (2000), discussed in Section 2.2.1, which states that the outcomes of CSCL can be just as, if not more, effective than face-to-face education, with collaborative learning being the crucial element. From a CSCW context, research by Duffy (1996), Grudin and Poltrock (1997), Mittman and Jackson (2001), Rama and Bishop (2006) and Olson and Olson (2009) all detail and advocate the use of groupware in enterprise environments over the last two decades.

While papers which advocate the use of groupware and its potential benefits in both education and enterprise are abundant, and numerous studies have reported successful and positive outcomes in the areas of CSCL and CSCW, groupware does not always live up to hopes or expectations. For example, Alexander (2006) attempted to

implement groupware-based teams into a large undergraduate class, and found that “not only did few students choose to be in virtual teams, indicating the tendency of individuals to maintain the status quo, but those who attempted this were unsatisfied with the process” (p. 143). Drawing from other studies, Alexander attributes the failure of the groupware implementation to several key factors:

- A lack of perceived need or incentive to utilise the groupware application rather than e-mail, which was more familiar to learners.
- A lack of learner support and preparation in regards to the technology and effective collaboration.
- A lack of time in which to develop trust amongst team members.

Other studies such as Straus (1997), Thompson and Coovert (2003) and Fjermestad (2004) have also had lacklustre results. Prominent issues identified include confusion or conflict in group discussions, a lower level of group cohesion, and the need for more time for groupware-supported groups to complete tasks compared to those in face-to-face environments. Such issues once again stress the importance of designing, implementing and supporting collaborative learning and group-based work in a pedagogically sound manner, rather than as an opportunistic offering – topics as discussed in previous sections of this literature review.

The phrase ‘anywhere, anytime’ has been used in this thesis and the literature to describe some of the key advantages of online education and the software used to support it, referring to the ability for learners to participate from any location and at any time, as opposed to the single location and time required for traditional face-to-face learning. Time and location requirements are two of the defining aspects of many pieces of groupware, communication software and other concepts or technologies discussed in this literature review. In order to summarise these tools from the perspective of time and location, Figure 2.7 depicts them upon a ‘time/space matrix’, a diagrammatic framework often used in human-computer interaction and CSCW literature (Baecker, Grudin, Buxton, & Greenberg, 1995; Dix, Finlay, Abowd, & Beale, 2004; Johansen, 1988; Mittman & Jackson, 2001).

	Same Place	Different Place
Same Time (Synchronous)	Early GDSSs	Late GDSSs
	Traditional Education	Virtual Classrooms
Different Time (Asynchronous)		Synchronous Groupware
		Chat Rooms & Instant Messaging
		Audio & Video Conferencing
		Telelearning
	General Purpose Workstations	OLEs (majority of features)
	Bulletin Boards	Asynchronous Groupware
	E-Mail & Discussion Forums	
	Blogs & Wikis	
	Early Distance Education	
	e-Learning (majority of methods)	

Figure 2.7 – Time/Space matrix of group or communication-related software, tools, concepts and technologies

While Figure 2.X is by no means exhaustive, it can be seen that the majority of tools, concepts and technologies facilitate collaboration or communication between people in different locations, supporting either synchronous or asynchronous interaction. While not discussed in this literature review, general purpose workstations and physical bulletin boards have been included as examples in the ‘same place, different time’ quadrant. The tools, concepts and technologies in the ‘different place, different time’ quadrant are of the highest relevance to this research.

Building upon the introduction to constructivism and collaborative learning in Section 2.1, this section of the literature review has explored the central role these learning strategies play in online education. Collaborative learning is widely regarded in the literature as a crucial component to ensure the effectiveness of modern online learning. The evolution from distance education to e-learning has progressed from attempting to apply traditional pedagogies to new environments, to implementing constructivist-based and collaborative online learning environments. E-learning is also reaching a stage where developments are being driven by a desire to provide learning environments based on sound pedagogy, rather than technological opportunism.

While modern OLEs have come a long way in supporting collaborative learning both pedagogically and technologically, the use of groupware is often necessary to support learners completing complex or prolonged collaborative tasks online. Heavily used in both educational and enterprise environments, groupware provides the collaboration, communication and coordination facilities required to work effectively in an online group.

### ***2.3 Awareness in Groupware***

The previous discussion focused upon the emergence of constructivist-based pedagogies, collaborative learning and the evolution of online education, where groupware has been identified as a major component in supporting online collaboration. The final section of this literature review examines the topic of awareness in groupware, which relates the most directly to the current research. While an introduction to the core concept and history of awareness is presented, this section focuses upon areas of the literature which relate to awareness in asynchronous Web-based groupware environments, and the metrics and presentation of awareness mechanisms. Dourish and Bellotti (1992, p. 107) defines and describes awareness as:

An understanding of the activities of others, which provides a context for your own activity. This context is used to ensure that individual contributions are relevant to the group's activity as a whole, and to evaluate individual actions with respect to group goals and progress. The information, then, allows groups to manage the process of collaborative working.

Awareness is an important factor for all types of collaboration, however in face-to-face collaboration most awareness occurs implicitly and is often taken for granted. A group of people collaborating around a single table can hear and see what each other are doing. Everything from the sound of pen against paper to a person leaving the room provides valuable awareness information (Biehl et al., 2007; Gutwin, 1997; Gutwin & Greenberg, 1996, 1998, 2004; Olson & Olson, 2009; Steinfield et al., 1999). In an online environment this information is unavailable, and group members must often take explicit measures to make their presence and actions known or to discover the presence and actions of other group members information (Biehl et al., 2007; Gutwin & Greenberg, 1996, 2004; Steinfield et al., 1999). The lack of implicit awareness



information is one of the reasons why OLEs and groupware have been known to promote feelings of isolation in learners. These feelings of isolation are compounded by the fact that users can log in to the application at any time in an asynchronous manner (Carroll, Neale, Isenhour, Rosson, & McCrickard, 2003). Awareness is required for any type of collaboration, and awareness in groupware is considered to be one of the most important areas of research in online collaboration (Carroll et al., 2003; Dourish & Bellotti, 1992; Gross, Stry, & Totter, 2005; Jang, Steinfield, & Pfaff, 2000; Kirsch-Pinheiro et al., 2003; Preguiça et al., 2000; Rittenbruch & McEwan, 2009).

The importance of awareness support in groupware is emphasised by Carroll, Rosson, Convertino and Ganoë (2006, p. 16), who state that “being aware is not a primary goal, but is presupposed and prerequisite to all other goals” and that “taking the conscious time and effort to ‘become aware’ takes time and effort away from the task at hand.” Research into the issue of awareness in online and computer-mediated collaboration has been frequent since the mid 1980s – firstly establishing its importance, and then aiming to discover and refine ways in which to increase the level of awareness in collaborative environments (Borges et al., 2005; Borges & Pino, 1999; Gross et al., 2005; Rittenbruch & McEwan, 2009). The literature examining awareness is extensive and encompasses topics such as the social context of awareness, the development of collaborative environments to support awareness, the capture and display of awareness information, and the development of awareness frameworks and models (Rittenbruch & McEwan, 2009, pp. 13-30). While a thorough examination of all aspects of awareness research is outside the scope of this literature review (interested readers see Markopoulos, De Ruyter, & Mackay, 2009), the topics, frameworks and mechanisms which relate to or provide a context for participation awareness will be discussed.

The type of awareness which strives to replace the directly observable awareness information available in face-to-face collaboration is commonly referred to as “workspace awareness”. Workspace awareness is defined by Gutwin and Greenberg (2002, p. 412) as “the up-to-the-moment understanding of another person’s interaction with the shared workspace.” By providing up-to-the-moment information about the presence and actions of others, workspace awareness aims to facilitate

direct collaboration in a synchronous environment. Workspace awareness is critical in synchronous groupware applications where group members collaborate in real time, such as the joint editing of a text document, or participating in a group drawing or planning exercise. For this type of collaboration to be successful, workspace awareness must make users aware of not only who is currently using the system, but exactly what they are doing, and when they do it. Workspace awareness mechanisms achieve this by techniques such as showing the cursors of other users and highlighting which area of the workspace they are currently viewing (Gutwin & Greenberg, 1998, 2002, 2004; Gutwin, Stark, & Greenberg, 1995; Schmidt, 2002). Such a form of awareness is highly context-sensitive (Borges et al., 2005; Brézillon, Borges, Pino, & Pomerol, 2004a, 2004b). Examples of early implementations, from Gutwin, Stark and Greenberg (1995), are depicted in Figure 2.8. Similar techniques and mechanisms can be observed in modern synchronous groupware, such as virtual classrooms as discussed in Section 2.2.1.

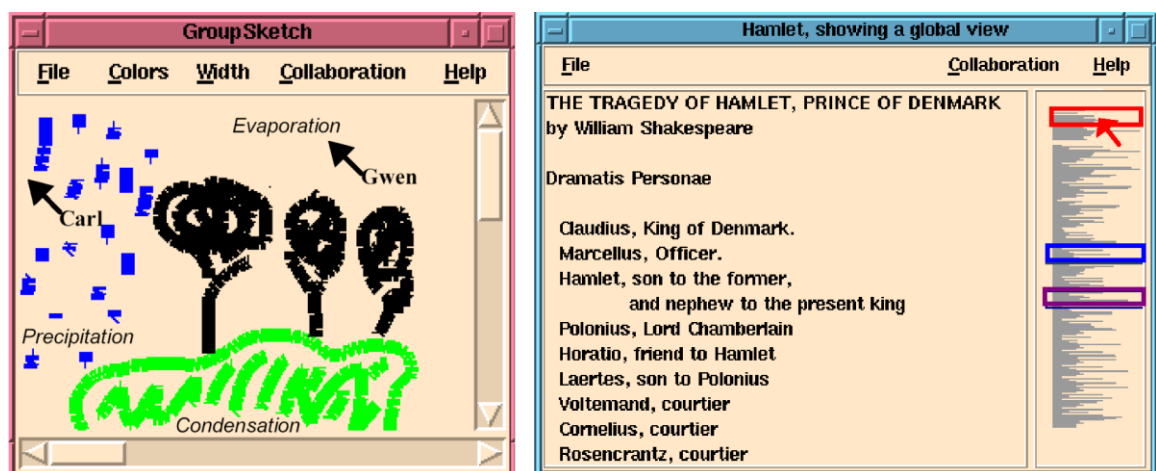


Figure 2.8 – Examples of workspace awareness mechanisms, from Gutwin et al. (1995)

While workspace awareness is crucial in synchronous groupware where direct collaboration is required, the literature indicates that a large proportion of online collaboration takes place asynchronously (J. Clark, 2000; Curtis & Lawson, 2001; Grudin & Poltrock, 1997; Tam & Greenberg, 2006). Tasks such as the collaborative authoring of a document are common in both educational and enterprise environments and often do not require much, if any, direct collaboration. Grudin and Poltrock (1997, p. 293) describe the process: “Teams writing large documents generally divide or ‘shred’ documents into sections that are assigned to different authors who work in parallel,

communicating with one another as necessary.” This is known in the literature as “loosely-coupled” collaboration. Coupling, a term pioneered by Salvador, Scholtz and Larson (1996), is described in Gutwin and Greenberg (2002, p. 426) as “the amount of work that one person can do before they require discussion, instruction, action, information, or consultation with another person.” Thus, loosely-coupled collaboration involves people working somewhat autonomously and requires less frequent interaction with group members. Tightly-coupled collaboration, however, requires frequent, often synchronous, interaction with others (Pinelle, Dyck, & Gutwin, 2003; Salvador et al., 1996). Participating in a virtual whiteboard or discussion activity with other group members is an example of tightly-coupled collaboration.

The literature suggests that the level of coupling required should be taken into account when designing groupware systems and the awareness mechanisms they employ (Churchill & Wakeford, 2001; Gutwin & Greenberg, 1996; Pinelle et al., 2003; Pinelle & Gutwin, 2003). Loosely-coupled collaboration is of higher relevance to this research, as participation awareness is intended for primarily asynchronous systems where group members rarely interact in real time. Long-term collaborative work in education and enterprise is typically loosely-coupled. Borges, Pino and Salgado (2000, p. 214) explain the importance of asynchronous awareness mechanisms:

One may easily see that a person cannot make valuable contributions to his group if he has not perceived previous information concerning the corresponding subject. .... Ignoring this information is like participating in a face-to-face meeting with all senses blocked, being impossible to see or hear other participants.

The research about awareness to support loosely-coupled asynchronous collaboration focuses on making group members aware of activity in the system since their last visit. Tam and Greenberg (2006) adapt Gutwin’s workspace awareness to propose a framework for “change awareness”, transcribing the up-to-the-moment elements of workspace awareness into the past tense. Adapted from Tam and Greenberg (2006), Table 2.3 summarises the relationship between workspace awareness and change awareness.

Table 2.3 – Workspace awareness and change awareness

	Workspace Awareness (present)	Change Awareness (past)
<b>Collaboration</b>	Tightly-coupled Synchronous collaboration	Loosely-coupled Asynchronous collaboration
<b>Who</b>	Who is in the workspace? Who is participating?	Who was here? Who made changes?
<b>What</b>	What are they doing? What object are they working on?	What has a person been doing? What changes have been made?
<b>Where</b>	Where are they working? Where are they looking?	Where has a person been? Where were changes made?

The change awareness framework proposed by Tam and Greenberg (2006) implements awareness at the object level. It highlights changes within individual objects in a groupware application such as textual documents, blueprints, diagrams and even images (Tam, 2002). Similar to workspace awareness, the context of change awareness is of high importance, as an understanding of the context in which change has occurred is required for users to extrapolate meaning from the event (Borges et al., 2005; Brézillon et al., 2004a, 2004b). It is more common in this area of the research for asynchronous awareness mechanisms to be implemented at the application level, encompassing all objects, users and actions in a groupware environment. Known under several names including ‘activity awareness’, ‘event awareness’ and ‘event-based activity awareness’, these mechanisms are typified by the provision of a list of recent events which have occurred in the system (Kirsch-Pinheiro et al., 2003; Preguiça et al., 2000; Rittenbruch & McEwan, 2009). Events are generated by users performing actions in the system, many of which are already discernable in spite of awareness mechanisms, such as contributions of work or feedback. Other events, such as users logging into the system or downloading files, would often remain unnoticed if not for awareness mechanisms. Such actions are sometimes referred to as “passive” or “transparent” actions (Borges et al., 2000; Jang et al., 2000; Preguiça et al., 2000). Providing an explicitly detailed list of recent events allows group members working asynchronously to be ‘brought up to speed’ on any activity that has occurred since their last visit. “It is especially helpful for group members to be cognizant of any modifications to shared objects such as documents or designs” (Steinfeld et al., 1999, p. 83).

Mechanisms such as event-based activity awareness serve to create common ground and shared memory, ensuring all group members have an equal understanding of the state of the environment and group project, regardless of which activities they participated in (Borges et al., 2000; Borges et al., 2001; Gutwin & Greenberg, 2004; Jang et al., 2000; Pinelle et al., 2003; Pregoça et al., 2000; Rittenbruch & McEwan, 2009). Event-based activity awareness mechanisms have multiple benefits, including reducing the risk of double-work and integration problems, adding to a group's shared knowledge, increasing task cohesion, promoting a natural working environment and decreasing feelings of isolation – all of which help to support effective collaboration (Bjørn, Fitzgerald, & Scopula, 2003; Borges et al., 2000; Convertino, Neale, Hobby, Carroll, & Rosson, 2004; Farschian, 2001; Kirsch-Pinheiro et al., 2003). Pregoça et al. (2000, p. 71) summarise the importance of awareness in asynchronous collaboration:

Awareness has been identified as important in the development of collaborative activities because individual contributions may be improved by the understanding of the activities of the whole group. .... In asynchronous collaborative activities, awareness information plays a central role in collaboration allowing each user to take notice of new contributions from other users.

While event-based activity awareness has been implemented in numerous groupware applications, researchers have noted that “systematic solutions for the awareness support are not common” (Kirsch-Pinheiro et al., 2003, p. 50), and that “awareness support presented to date involves localized solutions to specific domain problems, and isolated approaches and principles that are difficult to generalize to other situations” (Gutwin & Greenberg, 2002, p. 412). This research addresses these issues by developing a generically applicable awareness model. While participation awareness utilises information which is commonly used in event-based activity awareness, it must be stressed that the two types of awareness are in no way mutually exclusive. Event-based activity awareness is, important in supporting loosely-coupled collaboration in asynchronous groupware and should be present alongside any implementation of participation awareness.

Kirsch-Pinheiro, De Lima and Borges (2003) proposed a framework named Big Watch (BW). It was intended to support past event awareness in a flexible and generic manner that could be utilised in both existing groupware systems and newly developed ones. To achieve this outcome, BW uses an event-based three-phase cycle of “registering, monitoring and notifying”. The events and actions within the system that constitute awareness information are first registered into the framework for recognition. BW then monitors system usage and notifies users when events occur. As not all users require knowledge of a potentially very large number of events, BW focuses on filtering awareness information based on roles and preferences. The potential for information overload of awareness information is an issue that has been recognised by several authors (Borges et al., 2001; Pinelle et al., 2003; Steinfield et al., 1999). BW succeeds in providing a flexible, role-oriented, framework for past event awareness support, and is an example of an awareness mechanism designed for generic applicability. BW has similarities to participation awareness in that it defines, captures and presents awareness information. However, setting it apart from the current research is the fact that BW, like most other past event awareness mechanisms, provides explicit details of individual events as opposed to a summarised or aggregated display. While event-based awareness information is suitable for communicating distinct and defined actions, it does not lend itself to providing an overarching representation of participation. Furthermore, BW and similar mechanisms and frameworks are often heavily role-oriented, in order to minimise the potential for information overload and increase the relevance of the awareness information provided to users. The author feels that participation awareness avoids the potential for information overload by providing aggregated information rather than explicit details of individual events. As the information provided presents an overview of participation, the importance of role-oriented relevance is diminished. Furthermore, an awareness model or framework that is heavily role-oriented is limited in its generic applicability, as the existence or implementation of user roles varies greatly amongst groupware applications.

The types of awareness discussed in this section fulfil two distinct awareness needs in groupware. Workspace awareness facilitates tightly-coupled collaboration in synchronous systems, while change or event-based activity awareness supports loosely-coupled collaboration in asynchronous systems. These types of awareness rely on communicating to users exactly what other users are doing or have done. Participation awareness, as presented in this research, aggregates distinct pieces of awareness information in order to provide users with an at-a-glance cumulative display of participation. The concept of aggregation is briefly discussed in Gutwin (1997), Steinfield, Jang and Pfaff (1999) and Tam (2002), however these examples filter and summarise explicit information, rather than aggregating it. Reports of awareness mechanisms which aggregate distinct pieces of awareness information are rare in the research literature. The best example in early literature is the 'Participameter' described by Borges and Pino (1999), one of a number of awareness mechanisms developed to assist group coordinators in asynchronous groupware environments. Borges and Pino (1999, p. 71) advocate the use of summarised and aggregated awareness information:

One may think the greater the amount of information provided the better is the mechanism, but this is not true. .... Information should appear at the right time and be as concise as possible to avoid information overload.

In order to summarise awareness information, the Participameter uses percentages to portray contributions and how users have interacted with content in the groupware application. For quick recognition, a background colour on a scale from white to blue is used, matching the percentage (Figure 2.9).

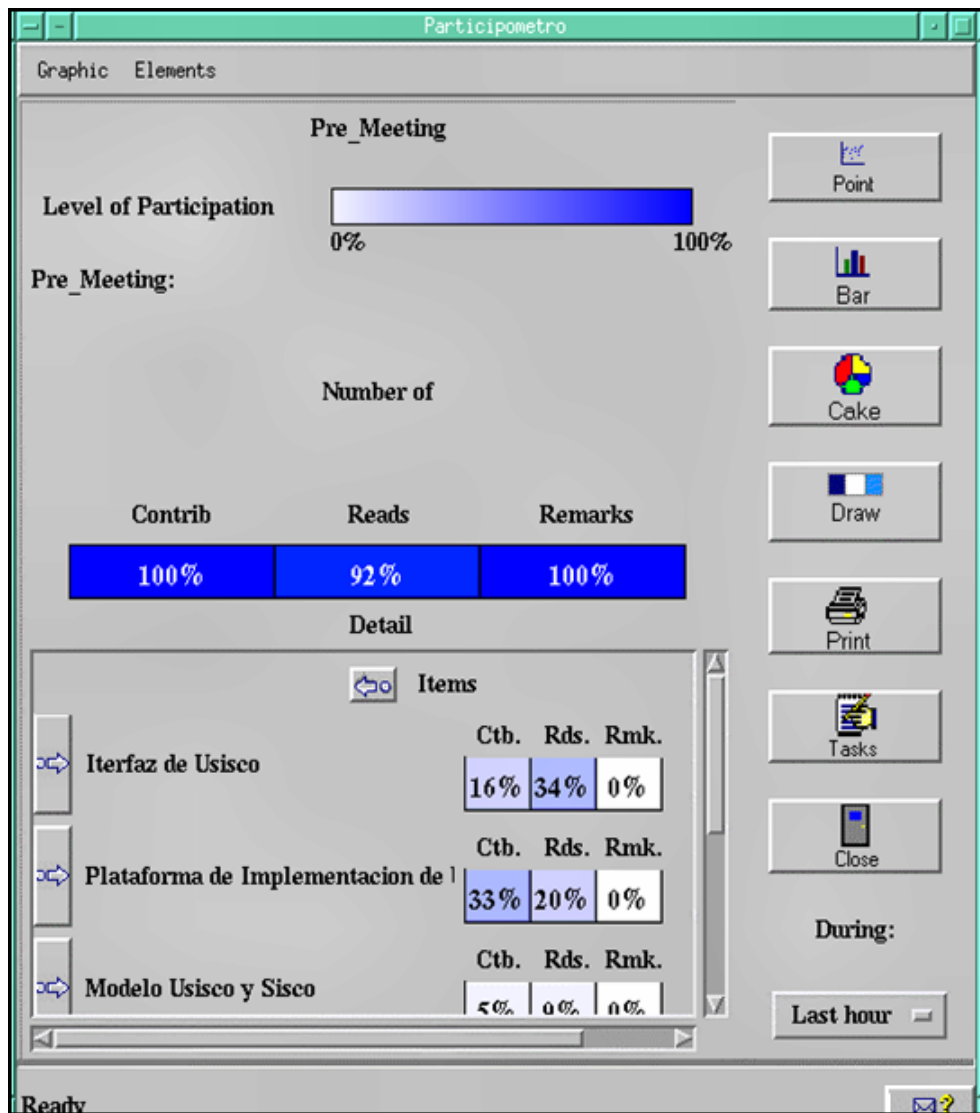


Figure 2.9 – The Participameter, from Borges and Pino (1999)

The Participameter illustrates the concept of using aggregated awareness information to provide an at-a-glance summary rather than an explicit list of events. It was intended for use by group coordinators rather than group members themselves and “provides the coordinator with elements to decide on what to do when, for example, the level of participation in a certain item is low: remind people, promote discussion with some controversial statement or even drop the topic” (Brézillon et al., 2004a, p. 120).

Zumbach et al. (2004) implemented an awareness and feedback mechanism dubbed “Interaction History” into an asynchronous Web-based collaborative environment. This research recognised that:



During computer-mediated communication, data on interaction can easily be recorded, stored and re-used for feedback purposes. In addition, software interfaces designed for CSCL allow collecting individual quantitative data that can be used for further computations in real time. Both data sources combined can easily be used to analyze individuals' and groups' behavioral processes automatically. (p. 90)

This is fundamentally the same technical concept upon which participation awareness is based. The mechanism implemented by Zumbach et al. recorded the “contribution behavior of each learner ... and, in relation to all other group members' contributions, quantitatively represented [the data] as a pie chart” (p. 91). Unlike Borgs & Pino's (1999) Participameter, the pie chart in Zumbach et al. (2004) was intended to benefit group members by providing them with feedback to help identify problems of motivation and participation. This feedback could be used as a basis to improve the effectiveness of collaboration. In more recent publications, the creators of the Participameter have acknowledged the relevance of providing aggregated awareness information to participants. “The person may also appreciate if the system tells him how many contributions he has made and how that relates to the number of contributions provided by the other participants (aggregated meta-information)” (Brézillon, Borges, Pino & Pomerol, 2004b, p. 2).

This research aims to create a generically applicable model of participation awareness. The primary constituent of this model is the participation metrics, as established in the first supporting research question. While the metrics entail all processing required to aggregate individual events into meaningful awareness information, the first step is obviously the definition and capture of events that represent participation in the environment. Since workspace awareness aims to facilitate direct synchronous collaboration, the information communicated is transient and not suitable for use as metrics of participation awareness (Gutwin, 1997; Gutwin & Greenberg, 2002). However, a number of metrics can be drawn from event-based activity awareness, as the events conveyed represent activity in the groupware environment. Thus, possible metrics include directly observable events such as the contribution of work, participation in online discussion and provision of feedback, as well as transparent events such as logging in, downloading files and viewing contributions (Borges et al., 2000; Jang et al., 2000; Preguiça et al., 2000; Steinfield et al., 1999). Metrics drawn

from events occurring in the groupware environment allow for the distinction of direct and indirect participation. This distinction recognises that users who perform passive actions such as reading the contributions of others are still participating to some extent (Beaudoin, 2002; Borges & Pino, 1999; Ogata & Yano, 1998). Such events were implemented as metrics in the aforementioned Participameter.

Pozzi, Manca, Persico and Sarti (2007) present a general framework for the analysis of learning processes in asynchronous groupware, based on the works of Henri (1992) and Garrison and Anderson (2003). Pozzi et al. define three categories of indicators of participation (p. 172):

- Indicators of *active participation*, which include the number of messages sent by individual participants, the number of documents uploaded, the number of chat sessions attended, etc.;
- Indicators of *passive participation*, which include the number of messages read, the number of documents downloaded, etc.;
- Indicators of *continuity*, that is the distribution of participation along time.

The importance of indirect or passive participation is recognised in this research, and some actions that can potentially serve as metrics of participation awareness are listed. In the participation awareness mechanism implemented in prior research by the author (Baatard, 2006), distinctions were made between contribution, participation and activity (Figure 1.1). Contribution and participation represented direct and indirect participation, while activity represented a user's presence in the system through actions such as logging in regularly and communicating with other users. Participants of the this research study (Baatard, 2006) indicated the quantitative nature of the participation awareness mechanism to be an issue. One participant stated that "although this [the participation awareness feature] is important to make sure everyone is contributing, they only reflect the quantity of participation not quality. Some people may respond less but their responses may be of a better quality" (p. 51).

The measurable metrics of participation in a groupware application are by nature quantitative, as it is not currently possible for a system to assess the quality of contributions in an intelligent and autonomous manner. One way of implementing a qualitative element to the metrics is to introduce a user-driven rating feature, which allows users to indicate the quality of contributions in the groupware application. Steinfield, Jang and Pfaff (1999, p. 85) suggest the use of such metrics and state that “a mixed approach that combines embedded system logging with explicit but optional provision of information may be a useful compromise”. However, other researchers warn that requiring or relying upon users to provide awareness information has the potential to increase workload, cause distraction and result in disuse of such mechanisms (Carroll et al., 2003; Dourish, 1997; Dourish & Bellotti, 1992; Schmidt, 2002; Steinfield et al., 1999). This research investigates the issue of qualitative metrics to determine their applicability and effectiveness in a model of participation awareness. The literature discussed has introduced a number of elements of note regarding the metrics of participation, including the events that can be captured, the importance of indirect participation and the quantitative nature of the metrics. The current research examines these elements in the context of participation awareness.

The second supporting research question concerns the effective presentation of participation awareness. How an awareness mechanism is perceived, interpreted and utilised by users is heavily influenced by how it is presented (Endsley, 1995; Gutwin, 1997; Steinfield et al., 1999). The majority of the research that examines the presentation or display of awareness information relates to the filtering of information based on roles and the logistics of presenting explicit information. Such issues are not the focus of this work as they concern role-based and explicit awareness mechanisms, while this research aims to provide a model of participation awareness that is generic and cumulative. Other literature (for example, Correa & Marsic, 2003; Gutwin, 1997; Hill & Gutwin, 2003) concerning the presentation of awareness information is focused upon real-time workspace awareness, which also falls outside the scope of this research.

Steinfeld, Jang and Pfaff (1999, pp. 84-85) discuss the delivery of awareness data in asynchronous groupware environments, outlining six key attributes. The first of these concerns the passive or active delivery of awareness:

In the passive situation, the collaborative system monitors particular information and delivers it without requiring any specific actions on the part of group members. .... Active systems, on the other hand, require group members to take specific actions to request awareness data, and are therefore less intrusive. However, this can result in the underutilization of awareness data, as well as being an added burden on group members. (p. 84)

The second attribute discusses whether awareness information is differentiated between users based on their roles, tasks or expertise within a group. While Steinfeld, Jang and Pfaff make a valid point in stating that “an undifferentiated delivery of awareness would overload all group members with potentially irrelevant information” (p. 84), the potential of information overload is greatly lessened in an aggregated or cumulative awareness mechanism, particularly in an environment which is not role-based. The third attribute concerns customisation, defined as “the degree of configurability the users have in determining the awareness information they receive” (p. 84). A high degree of customisation is appropriate in certain awareness mechanisms such as event-based activity awareness, as it allows users to filter awareness data to meet their needs. However, due to its cumulative and aggregated nature, customisation is largely inappropriate in participation awareness. While users may be able to customise the way in which data is presented, allowing them to customise the data undermines the consistency and objectiveness of the mechanism.

The question of awareness information being focal or peripheral is the next attribute discussed in Steinfeld, Jang and Pfaff (1999, p. 84). While the peripheral delivery of awareness information does not divert the user’s attention away from the task at hand, in an online environment it is inherently more difficult for the user to absorb awareness information via peripheral vision or hearing than in face-to-face environments. Awareness information as a focal point in the environment can be effective if it is presented as “a well-structured arrangement of inter-related information” (p. 84) that can be rapidly absorbed, in a manner described by Benford, Bowers, Fahlén, Marian and Rodden (1994, pp. 654-655) as “seeing at a glance”. The

fifth attribute concerns the scope of awareness mechanisms and whether they provide information within the groupware application alone, or across multiple applications, for example, e-mailing important updates to users. The final attribute of awareness information display concerns the need to ensure that it can be accessed from any location and be as independent of specific hardware and/or software as possible. The online nature of many modern groupware applications reduce the relevance of this issue, as predicted by Steinfield, Jang and Pfaff in stating that “the World Wide Web represents an increasingly attractive platform for developing collaborative tools for widely-dispersed groups” (p. 85).

The nature of participation awareness gives rise to a number of possibilities for its presentation. Prior research by the author (Baatard, 2006) utilised a numerical presentation method (Figure 1.1) to represent contribution, participation and activity as ordinal values. While some explanatory information was provided, the details of the calculations used to produce the values from events in the groupware application were not available to participants. This led to suggestions in participant responses that all calculations should be made transparent to users via documentation or that raw statistics should be presented (p. 60). At the other end of the spectrum from raw statistics is the graphical presentation of participation awareness information. Aggregated, cumulative awareness information based on quantitative data lends itself well to dynamically-generated graphical representation. The pie chart utilised in Zumbach et al. (2004) is an example of this, as is the coloured background utilised in Borges and Pino’s Participameter (1999). Figure 2.9 reveals that the Participameter was also able to produce a variety of graphs and charts. Further examples can be found in the contexts of both synchronous and asynchronous online discussion. Viegas and Donath (1999) proposed an online discussion application with a graphical interface named Chat Circles. This interface used coloured circles of varying sizes to reveal “the level of activity, or lack thereof, of each participant” (p. 11). In Chat Circles, each participant in a conversation is represented by a coloured circle which expands and increases in brightness with each message, and shrinks and fades during periods of silence (pp. 10-11). Part A of Figure 2.10 depicts an adaptation of the Chat Circles interface. The size and brightness of the circles indicates that Jane and John have participated heavily, while Bob and Mary have been relatively quiet.

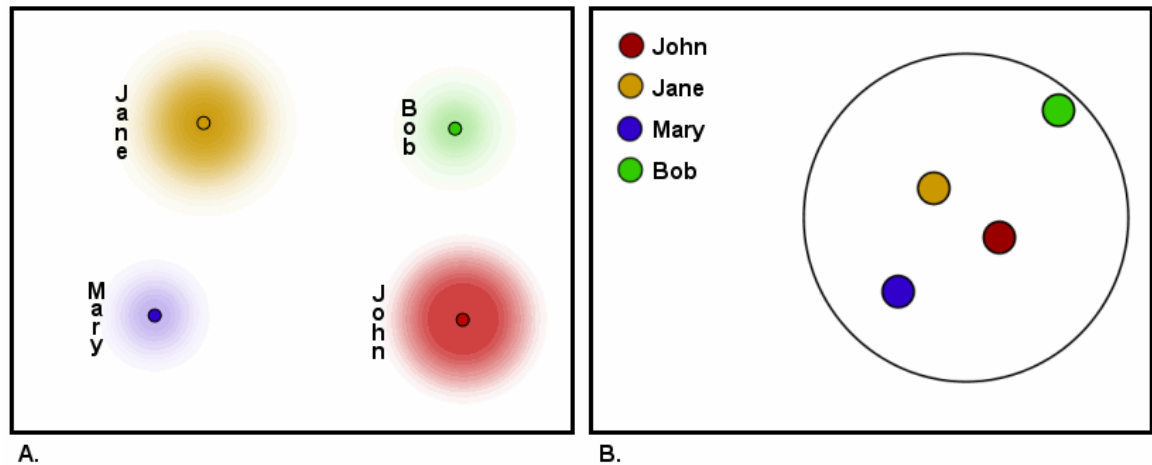


Figure 2.10 – Adaptation of Chat Circles (A) and Babble's social proxy (B) interfaces

Another graphical approach is that presented by Erickson et al. (1999) in an application named Babble. The graphical representation of users in Babble, known as the “social proxy”, involves a circle within which coloured dots represent users. The position of a dot inside the circle is determined by how actively that user is participating in the conversation, with users who are sending messages appearing closer to the centre. Indirect participation or “listening” also influences the position of the dots, measured by detecting mouse movements and clicks on the interface (pp. 74-75). Part B of Figure 2.10 depicts an adaptation of Babble's social proxy, and illustrates high participation by Jane and John, and low participation by Bob and Mary. These examples illustrate graphical representations of activity in online discussion and collaboration which could be adapted for the presentation of participation awareness information. To address the second supporting question, this research implements a number of different presentation styles to discover effective methods of displaying participation awareness.

Before concluding the discussion of awareness in the context of groupware or CSCL, it is worthwhile examining the concept of awareness-related features and mechanisms in common online scenarios. Social networking Web sites (Acquisti & Gross, 2006; Donath & Boyd, 2005; Kim, 2002; Lampe, Ellison, & Steinfield, 2006) such as Facebook, Friendster and MySpace focus heavily on making users aware of the actions of their peers. By allowing users to share content and respond to the content of other users, these services create a high degree of social awareness in an online environment.

Beyond this, records of user activity, or a lack thereof, are autonomously utilised by the software in order to raise awareness. For example, on Facebook a lack of activity by one user will result in suggestions to 'reconnect' with the user being made to his or her associates. Asynchronous discussion forums (Wright & Street, 2007) are prominent on the Internet and have incorporated numerous awareness mechanisms intended not only to raise awareness of activity, but to encourage sustained and high quality contribution. Many discussion forums will announce passive events that would otherwise go unnoticed such as the number times a thread has been viewed, as well as highlighting threads of high activity. The facility to rate individual posts or users is often implemented in discussion forums and online auction Web sites, adding richness to the communities by facilitating social concepts such as reputation amongst users (Conte & Paolucci, 2002; Dellarocas, 2006; Dellarocas, Fan, & Wood, 2004; Kim, 2002). Users who are rated highly or contribute frequently are often rewarded or recognised by the software in a publicly noticeable manner such as a title or graphical trophy. These examples represent a few of the features and mechanisms that increase awareness and encourage sustained and high quality contribution in online scenarios. Technologically, they are based simply upon the process of recording, processing and disseminating information available in the environment. The same process underpins the majority of awareness mechanisms, including participation awareness. Thus, the concepts and methods of awareness present in the areas of CSCL and CSCW are also present in all forms of modern communication and collaboration software and technologies.

This literature review began by discussing the emergence of constructivist-based pedagogies which have challenged traditional methods of education and have been adopted across all levels of education. Central to constructivism are concepts pertaining to the active and social construction of knowledge through interaction amongst peers, as opposed to the largely passive and one-way transfer of knowledge between instructors and learners epitomised in traditional education. Collaborative learning is a constructivist-based learning strategy which implements such concepts by utilising problem-solving group work amongst learners. Such strategies also foster the development of interpersonal and group work skills required in the workplace – where team-based work has been the norm for quite some time.

The prevalence of the Internet and supporting technologies has also had a dramatic impact on the way we learn and work. Where distance learning was once achieved via posted materials, it can now be supported online in OLEs that facilitate not only content delivery, but also interaction amongst peers and instructors that is a core principle of active and collaborative learning. Since both modern education and enterprise have a need to support effectively online collaboration, software designed to accomplish this has emerged. Known as groupware, it provides the features and facilities required to work effectively in online environments. Some groupware applications are entirely Web-based, offering groupware facilities from any location via a Web browser. This form of groupware is popular in educational contexts due to its accessibility and affordability. Collaboration in such environments is typically loosely-coupled, with collaborators working in an asynchronous and independent manner, sharing resources and communicating via the groupware environment as required.

The literature has found the issue of awareness in groupware environments is crucial to their effectiveness, as having an understanding of the activities of other group members provides an important context for one's own activities. A number of groupware features known as awareness mechanisms have been developed and implemented to address this issue. Awareness mechanisms seek to replace the high level of awareness which is implicit in face-to-face collaboration, but largely diminished in online environments. A common example of such a mechanism is event or activity awareness, where a list or summary of recent activity in the groupware environment informs group members of events of which they may have been unaware. Many current implementations of awareness mechanisms are not generically applicable and there is a lack of significant research regarding ongoing and aggregated forms of awareness and the measurement of participation. The scarcity of literature relevant to this form of awareness emphasises the unique nature of this research. By defining the metrics of participation and accurate and effective methods of presenting participation awareness, this research aims to develop a generically applicable model of participation awareness.



It is appropriate at this stage to summarise the theoretical framework of the research which has been established throughout the literature review (Figure 2.11).

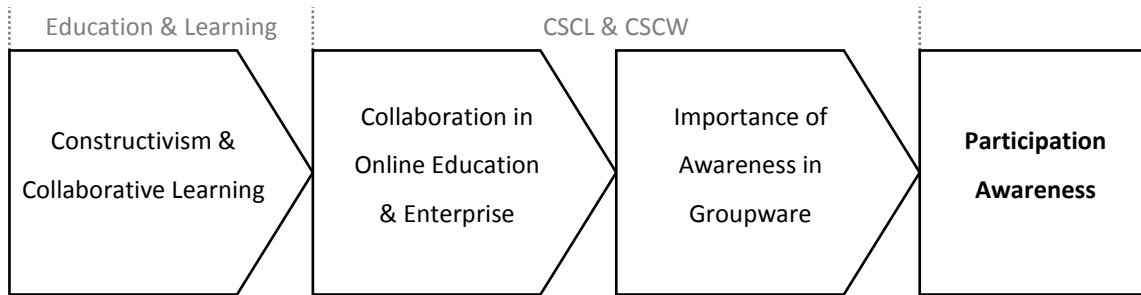


Figure 2.11 – Theoretical framework of this research

As the research concerns the development of an awareness model, the core theories guiding this research are those which recognise the importance of awareness in groupware. As detailed in this section of the literature review, awareness facilitates both synchronous and asynchronous collaboration in online environments and serves to promote common ground, shared knowledge and task cohesion amongst group members (Bjørn et al., 2003; Borges et al., 2000; Convertino et al., 2004; Kirsch-Pinheiro et al., 2003). The importance of these concepts was established in Section 2.1, which introduced the theories of constructivism and collaborative learning as the educational and pedagogical background to this research. In Section 2.2 the importance of collaborative learning in modern online education, and the role of groupware to support this was established.

## **Chapter 3 – Research Methodology and Design**

This chapter details the methodology and design of the research. Included in the research methodology section is an examination of the research methods selection processes, explaining how the author came to select the methodology that was used. The research design section covers the context of the research, including the groupware environment and participation awareness mechanism, and the context of the research participants themselves. An overview of all data collection techniques and mechanisms is presented. The research design section is supplemented by numerous appendices, reproducing the data collection mechanisms and supporting documentation in full.

### ***3.1 Research Methods Selection Process***

In justifying the methodology used in this research, this section discusses methodologies which were considered but rejected, the reasons they were deemed inappropriate, and elements of them that were incorporated into the research.

Experimental methods were considered inappropriate due to the nature of the research. While experiments are suited to the development of generalisable theories and models (Babbie, 2004, pp. 221-239; Galliers & Land, 1987; Kaplan & Duchon, 1988; Nachmias & Nachmias, 1981, pp. 77-101; Orlikowski & Baroudi, 1990) participation awareness is not something which lends itself to measurement in a controlled and abstracted environment. A true sense of participation is something which emerges over time in an authentic group work scenario, and hence it was felt that the external validity of the model would be undermined if measured in a short term experiment without regard to context. Furthermore, a comparison or contrast against a control was not feasible, as the research aimed to develop a model of a mechanism, rather than assessing its impact. For these reasons, longitudinal and qualitative methodologies were deemed to be more appropriate for this research.

Although ethnographic studies have been used in Information Systems (IS) development (J. A. Hughes, Randall, & Shapiro, 1992; Myers & Avison, 2002; Preston, 1991), ethnography was not deemed to be an appropriate methodology for the development of a generic model as such studies rely heavily on the social and cultural context of the people and scenario (Myers, 1997; Myers & Avison, 2002). Ethnographic studies may be suitable for the development of a system within a specific organisation, but does not lend itself well to producing a generic model (Williamson, 2002, p. 112). Some social and cultural elements were integrated into the research, via the collection of participants' demographic details such as age, gender and nationality.

Action research is an iterative research methodology which repeats a cycle of evaluation, implementation and review in order to improve a process or solve a problem while refining a theory (Avison, Lau, Myers, & Nielsen, 1999). Action research was deemed inappropriate for the current research as it aims to address an "immediate problematic situation" (Avison et al., 1999, p. 94) rather than develop a generalisable theory or model (Benbasat, Goldstein, & Mead, 1987, p. 371). Action research also involves the researcher becoming an active participant in the field (Williamson, 2002, p. 112), which is likely to disrupt the natural context needed to observe participation accurately. The research incorporated the iterative nature of action research to a degree, by conducting a pilot study followed by a main study, as detailed in Section 3.3.1.

As the study which prompted the current research (Baatard, 2006) utilised a multiple case study design, this methodology was initially considered. The aim of this research was to create a generic model of participation awareness, and hence a case study methodology was deemed inappropriate due to the heavy focus on the context of the case (Benbasat et al., 1987; Yin, 2002), which has been said to render the method "incapable of providing a generalizing conclusion" (Tellis, 1997). This lack of generic applicability is recognised by Eisenhardt (1989), who states that "the case study is a research strategy which focuses on understanding the dynamics present within single settings" (p. 534). While advocating that theory can be built from case study research, Eisenhardt accepts that such theories can be "narrow and idiosyncratic" (p. 547) due

to the method's reliance on specific case settings. Case study research typically utilises multiple methods to collect data, including "archives, interviews, questionnaires, and observations" (Eisenhardt, 1989, pp. 534-535). A mixture of qualitative and quantitative methods was employed in this research, and elements of case study methodology were present. Some data analysis was performed from the perspective of discrete sets of participants, examining units and groups as 'cases' in order to identify trends and relationships.

### ***3.2 Research Methodology***

The majority of research in IS, the field of this research, has traditionally been based on quantitative methods and positivist perspectives, relying primarily on experiments or statistical analysis to produce objective results with little regard to context and the more 'human' elements (Kaplan & Duchon, 1988; Orlikowski & Baroudi, 1990). The value of qualitative methods has been recognised in modern research, as has the fact that when used independently both quantitative and qualitative methods have weaknesses. Kaplan and Duchon (1988, p. 572) provide an example of this in stating that "the stripping of context [in controlled experiment conditions] buys 'objectivity' and testability at the cost of a deeper understanding of what actually is occurring." The use of quantitative and qualitative methods in a single piece of research, often referred to as mixed methods research, is strongly supported in the literature (Bryman, 2007; Creswell & Tashakkori, 2007; Jick, 1979; Kaplan & Duchon, 1988; Steckler, McLeroy, Goodman, Bird, & McCormick, 1992; Tashakkori & Teddlie, 1998). When undertaking mixed methods research, it is important to integrate the quantitative and qualitative methods, rather than conducting them in parallel or leaning heavily to one method (Bryman, 2007; Creswell & Tashakkori, 2007; Kaplan & Duchon, 1988, p. 575). For this to be effective, mixed methods research must be designed as such from the beginning to ensure that using multiple methods better enables the researcher to address the research questions (Bryman, 2007).

The integration of quantitative and qualitative methods "has the potential to offer insights that could not otherwise be gleaned" (Bryman, 2007, p. 9), via the process of triangulation. Jick (1979) describes several benefits of triangulation, the archetype of

which is “convergent validation”, where results are reinforced by consistent findings using different methods. However, the value of triangulation extends beyond the testing of reliability and internal validation:

It can also capture a more complete, holistic, and contextual portrayal of the unit(s) under study. That is, beyond the analysis of overlapping variance, the use of multiple measures may also uncover some unique variance which otherwise may have been neglected by single methods. .... Triangulation may be used not only to examine the same phenomenon from multiple perspectives, but also to enrich our understanding by allowing for new or deeper dimensions to emerge. (Jick, 1979, pp. 603-604)

The literature strongly supports the use of mixed methods and triangulation (Bryman, 2007; Greene, Caracelli, & Graham, 1989; Jick, 1979; Kaplan & Duchon, 1988; Vidich & Shapiro, 1955), and therefore this research employed them in its chosen methodology.

A field study (Adams & Schvaneveldt, 1991, pp. 119-127; Babbie, 2004, pp. 281-309) was the primary methodology employed in this research, as a sense of participation and hence the perception of participation awareness, is something which develops best in an authentic scenario; one where participants are working together to complete a task in which they have a personal investment. While it is important to measure participation in a natural context, the specific scenario of this context was not a focus as the research aimed to develop a generic model, thus distinguishing it from a single or multiple case study (Benbasat et al., 1987; Myers, 1997; Tellis, 1997). The field study was conducted in a university environment, with participants consisting of students completing group-based assessable work in semester long units of study, often known as ‘courses’ in academic institutions. As a primary area in which online group work takes place, higher education provides an environment that is well suited to the development of a model of participation awareness. Furthermore, it could be argued that the measurement of group member participation is of higher relevance in an educational context than in enterprise. As recognised by Monk-Turner and Payne (2005) and Barfield (2003), students often have reservations towards group work due to a number of factors such as relying on others for their grade, the equal distribution and contribution of work, and finding time to dedicate to the group. These factors were all evident in prior research by the author (Baatard, 2006), and in this research, establishing higher education as the most pertinent environment for the development

of a participation awareness model. Participants utilised GroupShare, a groupware application developed by the researcher, which provided an online environment designed to assist them complete collaborative tasks required in their studies. Further detailed in Section 3.6.1, the application allows file sharing and communication to be conducted in a centralised online location. GroupShare contained a participation awareness mechanism (detailed in Section 3.6.2), providing each group with awareness information regarding the participation of their group members.

As Nachmias & Nachmias (1981, p. 243) state, “no method of data collection is without limitations, and as a result more than one method of data collection is needed.” This research utilised a number of qualitative and quantitative techniques to gather data in order to address the research questions. These techniques fell within two supporting methods, survey and observation. The survey techniques employed were questionnaires (the primary source of data) and semi-structured interviews. Observation was achieved via the collection of logs in GroupShare throughout the ‘usage period’ – usage period being defined as the duration of group-based work which participants used GroupShare to support. The usage period of each unit is defined in Section 3.3.3. The length of this period varied between the participating units. An overview of the research methodology is presented in Figure 3.1.

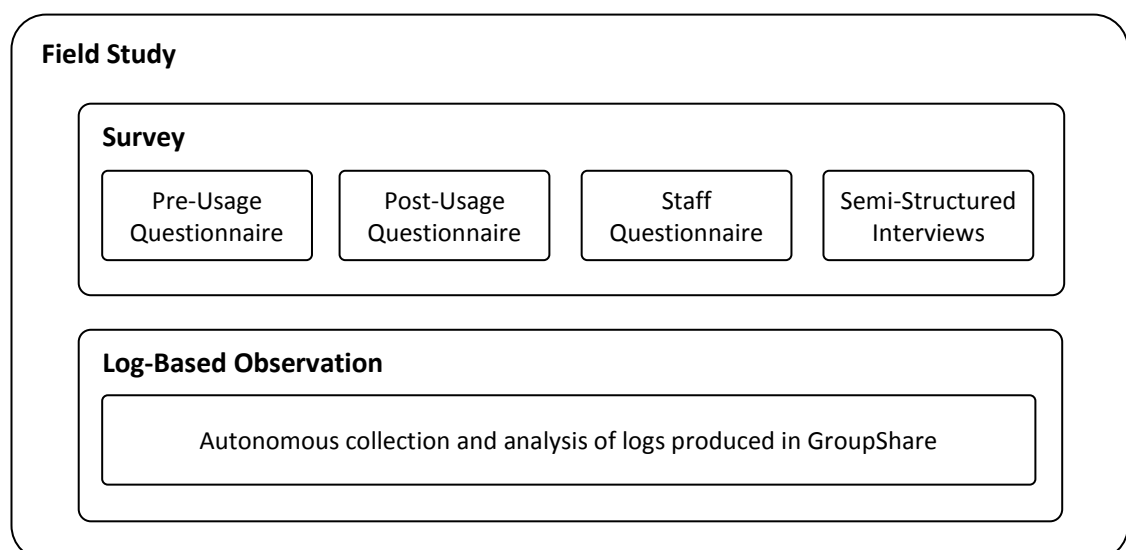


Figure 3.1 – Research methodology overview

The integration of survey in field-based methodologies has been recognised as an effective combination for the purposes of triangulation (Greene et al., 1989; Jick, 1979; Sieber, 1973), and it has been acknowledged that survey has a place in both positivist and interpretive research (Newsted, Chin, Ngwenyama, & Lee, 1996). Survey techniques such as questionnaires are a popular approach in IS research for a number of reasons, including ease of administration, strong objectivity and reusability and the production of generalisable results (Newsted, Huff, & Munro, 1998). The case survey is a variation of the survey methodology which aims to bridge the gap between nomothetic and idiographic research by administering and analysing questionnaires and interviews on a case-by-case basis. This serves to avoid the pitfalls of single case studies and produce more generalisable results, while maintaining the idiographic richness of case studies (Larsson, 1993). While this research placed a low emphasis on the individual cases (groups of students or participating units) and questionnaires were not administered on a case-by-case basis, case survey principles were utilised in order to identify trends and relationships specific to individual cases. This allowed each group's response to and perception of the participation awareness mechanism to be properly evaluated, while retaining a consistent scale of measurement. The questionnaires and semi-structured interviews administered in this research took place at the beginning and end of participants' usage periods, minimising the disruption of the natural environment.

A novel form of observation was employed, one which was deemed suitable in a field study where the 'field' was a computer software environment, with human-computer interaction being an important aspect of the research. All participant interactions with GroupShare were recorded as logs in real-time, providing a complete catalogue of each participant's usage of the application. Details of the content and structure of the logs are presented in Section 3.4.6. While observation has been a supporting and even the core data collection mechanism of countless pieces of research in various fields throughout history, the definitions and techniques of observational methodology vary in the literature (Herbert, 1970). Broad definitions such as Weick's (1968, p. 358) "planned methodical watching that involves constraints to improve accuracy" establish little in the way of actual techniques, and does not specify if an observer should act as a scientist or a humanist (Herbert, 1970, p. 131). The scientific approach to

observation involves systematic planning and recording, capturing a more encompassing set of data that has been subjected to checks for validity and reliability (Selltiz, Jahoda, Deutsch, & Cook, 1959, p. 200), and often utilising technology to facilitate collection (Nachmias & Nachmias, 1981, p. 171; Trochim, 2006). The humanist or “artist” observer aims to paint a richer, more descriptive picture of events, focusing on what the researcher perceives to be valuable amongst all that is observed (Herbert, 1970, pp. 131-132). While the humanist approach is of value in highly qualitative case-oriented research, the scientific approach to observation is much more likely to result in findings which have external validity and reliability.

Observation via the autonomous collection of logs, which the author has defined as ‘log-based observation’, does not fit within the traditional classifications of observational methodology. While participants were informed that their actions were being recorded and it was self-evident in the fact that the participation mechanism and GroupShare as a whole could not possibly operate if this were not the case, the recording was autonomous and completely unobtrusive. Hence, while sharing the hallmarks of direct observation and continuous monitoring, this form of observation was sufficiently passive and ‘in the background’ as to minimise the possibility of introducing bias or of the Hawthorne Effect, which has been found to influence participants subject to this form of observation (Babbie, 2004, p. 286; L. Brown, 2004; Trochim, 2006). This capitalises on two core benefits of observation in research – the low impact on the natural setting, and the preservation of the relationship between the participants and their contextual background:

The data collected by observation may describe the observed phenomena as they occur in their natural settings. All too many research techniques introduce elements of artificiality into the researched environment. .... The relationship between a person and his or her environment is often best maintained in observational studies. Opportunities for analyzing the contextual background are improved by the researcher’s ability to observe the environment in operation with the observed. (Nachmias & Nachmias, 1981, pp. 156-157)

Audio and video recording are often suggested as tools to assist in the capturing of observational data, allowing the observer to observe in a systematic and thorough manner that is less prone to bias (Adams & Schvaneveldt, 1991, pp. 242-245; Nachmias



& Nachmias, 1981, p. 171; Trochim, 2006). Logging can be seen as the audio and video recorder of a computerised environment. It is without doubt a more quantitative form of observation, aligning itself with the scientific approach outlined above due to the systematic and impartial way that logs are autonomously collected. Despite the somewhat sterile nature of log-based observation, analysis of the resulting data allows rich and meaningful information to be deduced, such as accurately profiling a user's usage of a system over time, or their communicative trends with other users – information that would be difficult to observe unobtrusively using traditional techniques. Such applications of log data are presented wherever appropriate, and used heavily in Chapter 5. When necessary, the content or result of the interaction to which a log pertains can often be examined, allowing for further qualitative analysis. Log-based observation is a hybrid methodology, combining elements of traditional observation, unobtrusive methods such as document or content analysis (Babbie, 2004, pp. 312-340; Nachmias & Nachmias, 1981, pp. 243-266), and similar computer-based techniques such as that of 'clickstreams' (Andersen et al., 2000; J. Brown, 2005; Montgomery, Li, Srinivasan, & Liechty, 2004).

The methodology employed in this research closely resembles that utilised in Zitter, Kinkhorst, Simons and Cate (2009). Aiming to improve the design of e-learning environments, Zitter et al. performed two iterations of a field study in a higher education group work context. Amongst the data collection methods were a questionnaire, interviews with student and staff participants, and monitoring of a groupware application's usage. The successful usage of a similar methodology in a closely related area of research strengthens the validity of the methodology of this research. The use of survey and observation within a field study methodology allowed for a thorough holistic understanding of the research environment and the participants' response to the participation awareness mechanism. The methods employed were unobtrusive, allowing participants to work on their unit-based group work and develop a sense of participation with minimal interruptions or reminders that they were 'participating in research'. By using a mixed methods approach, the research was designed to be as appropriate as possible in order to determine the constituents of participation awareness in a generalisable manner, within the natural context required to do so.

### 3.3 Research Design

Yin (2002, p. 21) states that the main purpose of an appropriate research design is “to help avoid the situation in which the evidence does not address the initial research questions.” In order to demonstrate and justify the relevance of the research design and the data collection techniques which were utilised, Figure 3.2 shows the primary relationships between these and the research questions. The data collection techniques are expanded upon throughout the following sections.

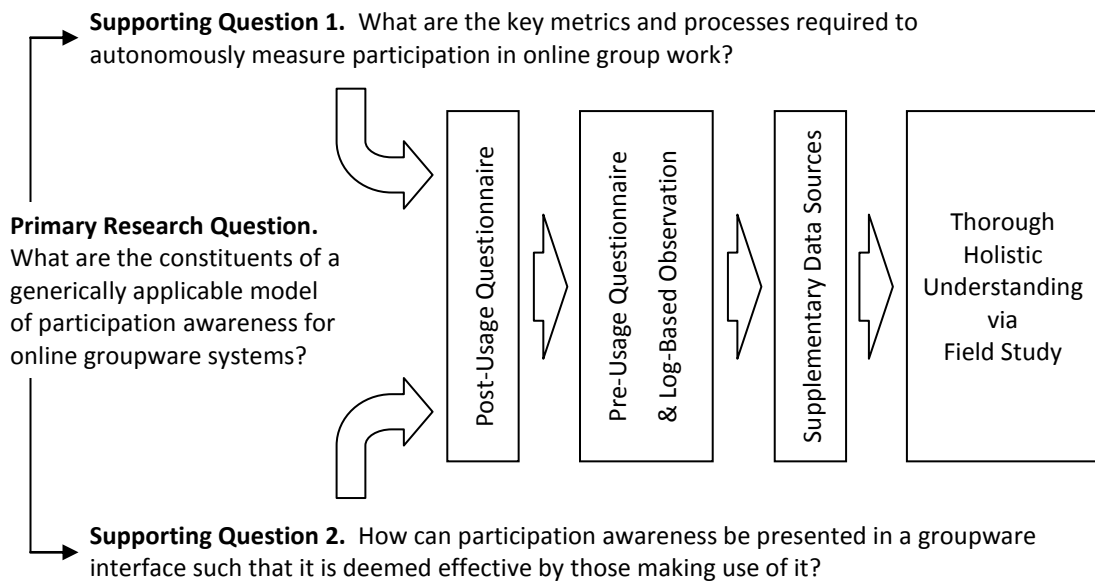


Figure 3.2 – Primary relationships between research questions and data collection techniques

As the source of data with the highest direct relevance to the research questions, the post-usage questionnaire takes the position of primary data source, from which initial analyses and observations are made. The pre-usage questionnaire and usage logs serve as secondary data sources, used in combination with the post-usage questionnaire data to further examine and refine observations. This is principally evident in Chapter 5, where the three data sources are utilised to create unit, group and participant profiles. Supplementary data sources, such as the student and staff interviews, allow for further examination and refinement, adding qualitative data to result in a rich understanding of the field study environment, and addressing the research questions in an appropriately thorough manner.

### **3.3.1 Research Structure**

As the data collection period of the research was one university year in length, the author chose to conduct two iterations of data collection – one in each university semester, consisting of thirteen teaching weeks apiece. While the first iteration, dubbed the pilot study, was not a ‘trial run’, experiences and findings from it were used to make refinements to the second iteration. Amongst the elements which were evaluated at the end of the pilot study were the suitability and functionality of GroupShare, participant recruitment procedures, GroupShare account and group maintenance, and the suitability of all data collection techniques. The pilot study progressed smoothly and only minor refinements were necessary, the most notable being an update of the server software used to host GroupShare. The overall research methodology and design was found to be highly suitable in the pilot study, and hence the second iteration, dubbed the main study, followed it closely. As there were no major changes or differences between the pilot and main study, the author felt that it was appropriate and valid to treat the cumulative data from both studies as a single combined data set for the purpose of analysis. Distinction between iterations was preserved, and was taken into consideration where suitable. Similarly, the differences between units were taken into consideration and data was analysed within the context of a group, unit or iteration where appropriate. The research structure detailed within the following sections applies to both the pilot and main study.

Participants of the research were students enrolled in semester long units that involved group work at a West Australian university. Such units typically entail either the collaborative authoring of a lengthy document, or the completion of a group project and associated documentation. Each teaching week normally consists of a lecture, followed by a practical workshop or tutorial. In units featuring group work, time is often dedicated to group-based work or meetings. Groups are usually made up of four to six students who have no prior experience working together. While the precise nature and duration of the group-based work was dependent on the units and teaching staff, the scenario described typifies group-based work not only in education but also in enterprise (Boud et al., 2001; Gibson & Cohen, 2003; Gratton, 2007; Thorley & Gregory, 1994) – making the chosen environment well suited to the development of

a generic model. Although most of the students in the participating units had a weekly face-to-face class, experience has shown that much of the work is completed individually and distributed online for collaboration amongst group members in a loosely-coupled (see Section 2.3) manner. Furthermore, a number of the students were enrolled in the online version of a unit and hence had no formal face-to-face contact with teaching staff or peers. The disparity between groups who had face-to-face contact and those who were wholly online was a pertinent factor, which was addressed in the research.

### **3.3.2 Participant Recruitment**

In order to gain support and participants for the research, an e-mail was sent to teaching staff delivering units in the same university department as the author, which is focused upon areas within computer science. Participants were sought from this department to allow the author to remain in close proximity, and due to the fact that computer-assisted group work is rarely seen in most other departments. While an Online Learning Environment (OLE) is present throughout the university, the nature of this school results in it making heavier use of Web-based resources and technologies than others do. Students in this school are typically well accustomed to the usage of OLEs and online communications. The cognitive load associated with implementing online group work and groupware usage to external departments was deemed inappropriate and not beneficial to the research. The e-mail was sent by the research supervisor and the author before the first teaching week of each semester, and gave an overview of the research and the ways in which support could be offered. It also provided documents which described the features and potential usage scenarios of GroupShare. The e-mail and its attachments are reproduced in Appendices B, C and D. Teaching staff who taught units known to have a major group work component were approached in person.

Support was requested in either an 'opt in' manner, where students would be asked to use GroupShare and participate in the research, or an 'opt out' manner, where GroupShare would be integrated into the unit as the standard online group work environment, and students were able to opt out of the research and/or usage of the

application. Several teaching staff offered their support, some choosing the opt in manner and others the opt out. The nature of the group work and the formation of groups remained at the discretion of the teaching staff, however efforts were made to form whole groups from participating students wherever possible to provide optimal group-based sets of data. Participants and non-participants alike completed the same group work, as required in the unit. Students who chose not to participate, either explicitly or by failing to complete the research questionnaires, were able to use GroupShare in exactly the same manner as participants.

In both iterations of the study, word of mouth resulted in requests from students to use GroupShare to support group work in units that had not initially offered support. This was granted after receiving approval from the appropriate teaching staff, and the group members were sent a consent form and participation instructions. In the main study, word of mouth from a pilot study participant resulted in receiving support from a staff member teaching a unit in another department of the university.

### 3.3.3 Research Implementation and Progression

Figure 3.3 presents a timeline of the implementation and progression of the research design, from a single-unit perspective. This is expanded upon throughout this section.

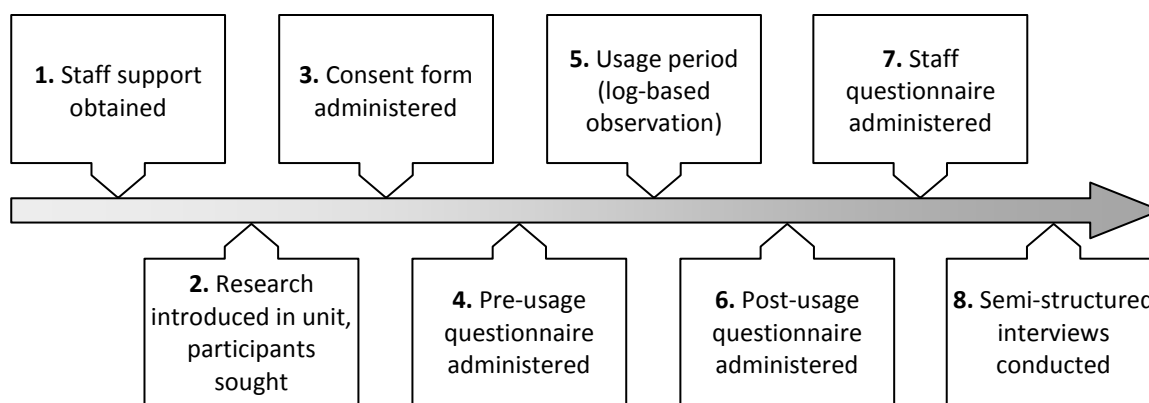


Figure 3.3 – Timeline of research implementation and progression

Units in which support was offered were visited by the author shortly before or during the formation of groups and commencement of the unit’s group-based work. Students were informed of the aims and methods of the research, and a demonstration of

GroupShare was conducted. As GroupShare is designed to support group work, it was presented to potential participants as a useful tool, rather than a burden in the name of research. Students were assured that their participation was voluntary, could be discontinued at any time, that their choice would have no impact on their grade, and that all results would be anonymised. The students were given time to discuss and ask questions, before a consent form (Appendix E) including basic contact and demographic details was administered to those wishing to participate in the research. The demographic data in the consent form included age, gender, nationality and course title; factors which have the potential to influence the dynamics of small group work (Shaw & Barrett-Power, 1998). For online students, e-mails were sent by the author and unit staff member in order to introduce the research and request participation (Appendix F). In lieu of demonstration, an attached document introduced GroupShare's main features (Appendix C), and an electronic version of the consent form was administered. All participants were given an information letter (Appendix G) that included the author's contact details and further information regarding the research.

Once the consent forms had been collected, participants were asked to complete the pre-usage questionnaire – either in class if the staff member had scheduled time to do so, or as soon as possible otherwise. Participants were then free to register an account in GroupShare and join the appropriate group with their group members. The exact procedure of this varied between units and the type of support offered. One staff member offering opt out support provided a list of group members in advance, which allowed the author to pre-register accounts and place users into the correct groups, while other units offering opt in support were enrolled in a more ad hoc manner. The initial rate of participant attrition was high, particularly in units offering opt in support. This was predicted by the author, based on prior experiences. While students liked the idea of GroupShare and were open to participating in the research, many of them simply did not end up finding a need for the application to support their group work. Judging by the responses to the pre-usage questionnaire, students who did not end up utilising GroupShare most probably preferred to work primarily face-to-face, or made use of communication tools such as e-mail and instant messaging to provide any online group support they needed. Use of these established tools to support group work is

well documented in the literature (J. Clark, 2000; Fichter, 2005; Grudin & Poltrock, 1997; Ragoonaden & Bordeleau, 2000). Based on the duration of group work, the usage period varied between units. Some units required group work for only a few weeks, while others were focused upon semester-long group projects. Figure 3.4 illustrates the usage periods of all participating units, calculated using GroupShare usage data. Details of each unit and their usage periods are presented in Section 5.1.

Pilot Study (Semester 1, 2008)													Main Study (Semester 2, 2008)												
1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	10	11	12	13
Pilot Study, Unit 1 (P1)													Main Study, Unit 1 (M1)												
Pilot Study, Unit 2 (P2)						Main Study, Unit 2 (M2)																			
Pilot Study, Unit 3 (P3)													Main Study, Unit 3 (M3)												
													Main Study, Unit 4 (M4)												
													Main Study, Unit 5 (M5)												

Figure 3.4 – Usage period of units over both studies (each green row represents a different unit)

Throughout the usage periods, the author responded to participant enquiries via the discussion forums available in GroupShare and e-mail. Enquiries from participants fell into two main categories, which were addressed as follows:

- Group member changes or issues:
  - Enabling/Disabling of group enrolments, with approval of teaching staff.
- GroupShare enquiry, error report or feature request:
  - Enquiries addressed, errors fixed and minor features implemented.

Group member changes were regular early in the usage periods, for common reasons unrelated to the research. For security and confidentiality reasons, participants were not able to remove themselves from one group and join another, hence requiring the assistance of teaching staff or the author to implement group membership changes. Enquiries regarding GroupShare and its features were received infrequently throughout both iterations of the study. Reported errors were fixed, and minor enhancements to the application were made as requested. An example of such enhancements was allowing multiple lines of input containing line breaks in the live chat feature, rather than the single line input that was originally implemented. In the pilot study, out-of-date server software resulted in small amounts of downtime during which GroupShare was unavailable. Every effort was made to minimise this, however upgrading the software was carried out between iterations of the study, as it was

deemed too large a potential inconvenience to participants should it not go smoothly. GroupShare did not suffer any downtime in the main study.

Towards the end of the usage period of each unit, the post-usage questionnaire was made available to participants, announced and accessible via GroupShare. A visit to participating units was conducted wherever possible, to announce the post-usage questionnaire and thank participants for their support. A questionnaire for the teaching staff providing support was also administered at this stage. Staff members had been informed of this questionnaire at the start of the semester, when discussing their support of the research. Participants were informed that they were welcome to continue using GroupShare after the completion of their unit's group work, and that the application would remain available until the end of semester. Semi-structured interviews were conducted towards the end of semester with participants who indicated that they were willing to be interviewed in the post-usage questionnaire and consent form.

### ***3.4 Data Collection Techniques***

#### **3.4.1 Questionnaire Design and Conventions**

The survey component of the research involved a pre-usage and post-usage questionnaire for student participants, as well as a semi-structured interview with those who were willing. Teaching staff offering support in their units were asked to complete a staff questionnaire and attend a semi-structured interview. The questionnaires formed the primary source of data, and hence great care was taken to ensure they were well designed. While data was gathered in the form of logs (Section 3.4.6) throughout the usage periods, the students were using GroupShare to assist in their unit-based group work, rather than consciously 'participating in research'. Hence, the questionnaires are the primary events in which participants explicitly and directly assist in the collection of data, providing, as Drew, Hardman and Hart (1996, p. 302) put it, a "link between the researcher and the data". Questions were worded neutrally, to avoid indicating a bias towards specific answers, and the language avoided being overly technical or using colloquialisms, both of which can confuse or



deter respondents. Care was taken to ensure that questions were not double-barrelled or ambiguous (Babbie, 2004, pp. 244-250; de Vaus, 2002, pp. 96-99; Nachmias & Nachmias, 1981, pp. 223-227). All questionnaires were pre-tested with the research supervisor, an academic university staff member unrelated to the research, and a small number of university students known by the author in order to refine the clarity of the questions further (Babbie, 2004, p. 256).

The questionnaires were administered online, utilising a simple Web-based interface which presented each section of a questionnaire individually (Figure 3.5). This was done to present the questionnaires to participants in a more manageable manner, to encourage their completion (Babbie, 2004, pp. 250-251; de Vaus, 2002, p. 110). A welcome and some instructions were provided in the first section of each questionnaire, explaining the format of the questionnaire and pertinent information regarding the research. Each section was headed with a title and short summary of what the section regarded, and included any instructions or resources relevant to that section. Where appropriate, questions included short instructions regarding how to respond, or providing further information about the content of the question. For example, "Check all that apply" in a question offering multiple checkboxes, and "Assuming a rating scale of 1 to 5 stars" in a question concerning rating group member contributions. Each of these levels of instructions and information play an important role in making questionnaires clearer to respondents, ensuring the questions are understood and answered in the correct manner (Babbie, 2004, pp. 255-256; de Vaus, 2002, pp. 109-110; Nachmias & Nachmias, 1981, pp. 230-232). Responses to the questionnaires were validated in real-time, ensuring that required questions could not be left blank, and that questions had been completed correctly and completely where such validation was possible. Questions that failed validation were highlighted when attempting to proceed to the next section of the questionnaire.

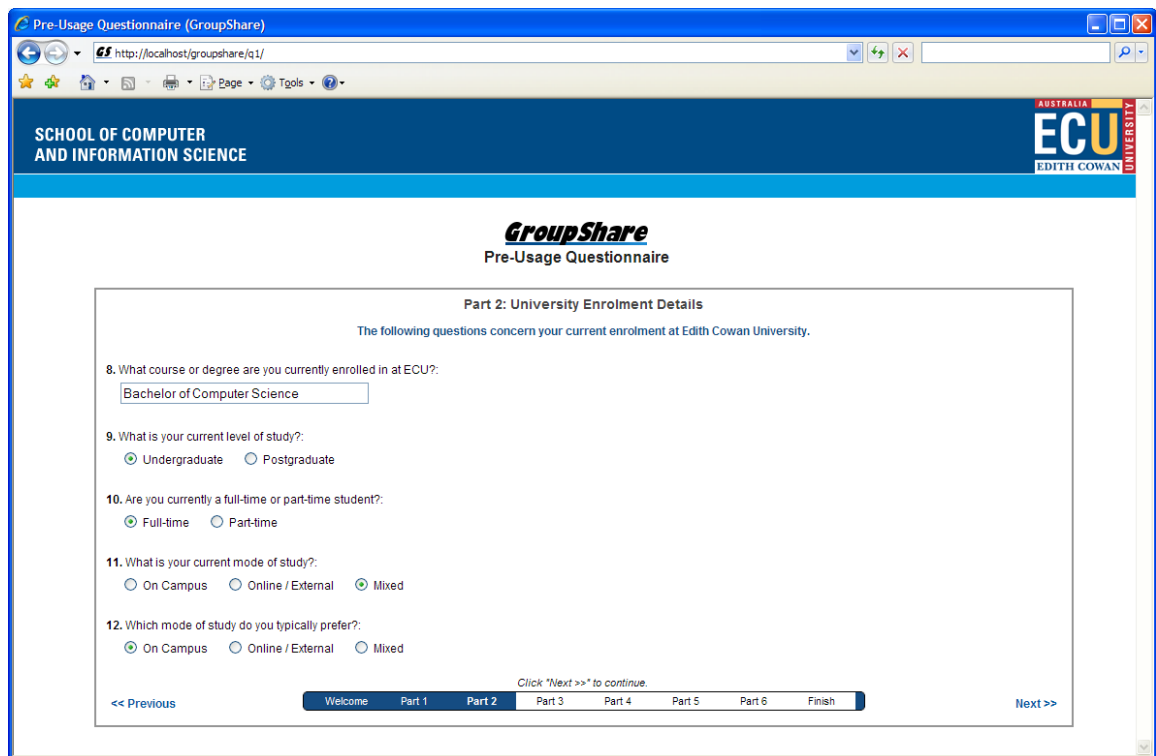


Figure 3.5 – Web-based questionnaire interface, showing a single section

Several types of questions were asked throughout the questionnaires, aiming to garner the most appropriate and detailed form of response, without requiring undue amounts of time and effort from participants. Likert-type (Babbie, 2004, pp. 169-170; de Vaus, 2002, p. 102; Likert, 1932) questions were common in all questionnaires, deemed highly appropriate to capture data relating to participant attitudes. While Likert-type ‘questions’ were in fact statements, they will be referred to as questions for the sake of readability and consistency. A five point scale was used, allowed participants to select ‘Strongly Disagree’, ‘Disagree’, ‘Neutral’, ‘Agree’ or ‘Strongly Agree’. Despite taking more space, Likert scales were always labelled in full, as this has been found to increase reliability and validity (Krosnick, 1999; Krosnick & Berent, 1990; O’Muircheartaigh, Gaskell, & Wright, 1995; Schaeffer & Presser, 2003). Series of Likert-type questions are often presented in a matrix format, which makes effective use of space and can assist respondents by being both faster to complete, and making it easier for them to compare their level of agreement or disagreement with their responses to previous questions in the matrix (Babbie, 2004, pp. 253-254). However, Babbie also warns that the matrix question format “can foster a response-set among some respondents: They may develop a pattern of, say, agreeing with all statements” (p. 254). The author tried for an optimal layout by arranging Likert-type questions

such that while the responses were lined up to facilitate rapid response, they were divided by the question text, encouraging respondents to read the question thoroughly before answering. Furthermore, care was taken to use both positive and negative phrasing in series of Likert-type questions, to discourage acquiescence (de Vaus, 2002, pp. 107-108; Krosnick, 1999, pp. 552-555; Nachmias & Nachmias, 1981, p. 244). Matrix format Likert-type questions were employed in select areas of the questionnaire; small sets of highly related questions that the author felt would benefit from the comparative answering technique previously described. As these sets consisted of only four questions each, the likelihood of a response-set or acquiescence developing was minimal.

Offering a neutral response in a Likert scale is sometimes discouraged, however the author felt it appropriate as it was perfectly likely that some participants would have no distinct opinion in regards to some questions (de Vaus, 2002, pp. 105-106). O'Muircheartaigh, Krosnick and Helic (2000) support the inclusion of a neutral response, finding that:

Contrary to the satisficing perspective, omitting the middle alternative did not lead people to report meaningful attitudes that they would otherwise not have bothered to describe, instead taking the "shortcut" of selecting the middle alternative. Rather, omitting the middle alternative significantly decreased the validity of responses and increased the amount of random error variance in responses, suggesting that people who genuinely belonged in the middle of the scale made essentially random choices among the alternatives. (p. 20)

In most sections, series of Likert-type questions were supported by open-ended questions, which can help to provide context for neutral, and other, responses. The questions had no default or pre-set values, ensuring that answering neutrally took as much effort as selecting any other answer.

Closed questions were used where there were a small number of possible responses. The questions and responses were carefully worded to ensure that they addressed each other, and that the responses were mutually exclusive and exhaustive (Babbie, 2004, pp. 245-246; de Vaus, 2002, pp. 100-101). Depending on the question at hand, respondents were able to either select a single response, or check multiple responses.

Closed and Likert-type questions were utilised more frequently than open-ended questions throughout the questionnaires as they were found to be the most appropriate, and allowed for more efficient coding of responses. Additionally, such question types are quicker and easier for respondents to answer, helping to alleviate the length of the questionnaire and encourage completion (de Vaus, 2002, pp. 99-100). When a question had a number of likely responses but not all possible answers could be quantifiably listed, an 'Other' response was available, allowing respondents to enter their own text. Such questions are described by Bordens and Abbott (2002, p. 222) as "partially open-ended items", retaining the simple coding benefit of closed questions, while ensuring that they are able to capture all possible responses.

Open-ended questions were used to supplement the quantitative data gathered via Likert-type and closed questions with qualitative data. Such questions were typically placed towards the end of a questionnaire section, asking overarching questions to encourage respondents to give further details or mention things that were not covered by the closed and Likert-type questions. The unstructured and unrestrained nature of open-ended questions ensured that the data gathered in the questionnaires was as rich and comprehensive as possible (Babbie, 2004, pp. 245-246; Burns, 1996; Krosnick, 1999; Nachmias & Nachmias, 1981, pp. 212-215).

A final type of question, a ranking question, was utilised in the questionnaires. Due to the contextual nature of such questions, discussion of them has been included in the overview of the pre-usage questionnaire – where the first of these questions occurs.

### **3.4.2 Pre-Usage Questionnaire**

The pre-usage questionnaire was administered before participants began using GroupShare, after the research had been introduced and the application had been demonstrated. Where time did not allow participants to complete the questionnaire at this stage, they were advised to complete it as soon as possible. Links to the questionnaire were available both on the login page of GroupShare, and in an announcement made on the application's Message Board.

The primary purpose of the pre-usage questionnaire was to gain an understanding of participants' existing attitudes and opinion towards group work, working online, and the measurement of participation. The questionnaire consisted of six sections (Table 3.1), which ranged from those regarding background and demographical details, to focused sections concerning participation in group work and groupware. The full pre-usage questionnaire can be found in Appendix H.

*Table 3.1 – Sections of the pre-usage questionnaire*

<b>Section #</b>	<b>Section Title</b>
1	Internet Usage & Experience
2	University Enrolment Details
3	Group Work
4	Group Support Software (Groupware)
5	Participation in Group Work
6	Measuring Participation in Online Groupware

The first pre-usage questionnaire section was entitled 'Internet Usage & Experience', aiming to gather background information regarding the participants' level of 'Internet literacy'. The section asked questions regarding the frequency and duration of Internet use, where it was used, what for, and the connection speed most commonly used. The section concluded with two Likert-style questions, asking participants to indicate if they consider themselves to be experienced Internet users, and if they often use resources on the Internet to support their studies.

Section two was titled 'University Enrolment Details'. It asked participants which degree they were enrolled in, whether they were undergraduate or postgraduate students and whether they were studying part or full time. Participants were also asked about their current mode of study - either on campus, online/external, or a mix of the two – and which study mode they typically prefer. This section served to gain further insights into the background and context of participants.

The third section, 'Group Work' began by asking students how many times they had been required to work in a group as part of their university studies, and how much of this work had been conducted in an online environment. A series of Likert-type questions followed, regarding various aspects of group work in an educational context. The topics covered included whether participants found group work to be more

challenging than individual work, whether it was more appealing, and whether they felt they learnt more, as well as the importance of equal participation and if they had experienced equal participation in prior group work. The section also asked participants to identify their primary means of contacting group members when completing group work at university, and open-ended questions regarding what they liked most and what they liked least about group work concluded the section.

The fourth section was called 'Group Support Software (Groupware)'. It asked participants if they had utilised the online learning environments used to manage courses and units at university, and if they had ever used groupware to support group projects unrelated to their studies. Participants were asked to identify the groupware applications used, and provide an open-ended summary of what they were used for if applicable. The section ended with two Likert-style questions, asking students if they felt that the use of groupware to support group work was beneficial, even when some face-to-face contact is possible, and if they felt that groupware was more beneficial than using a general communications tool such as e-mail or a discussion forum.

Section five, 'Participation in Group Work', opened with a Likert-type question asking if participants believed that participation in group work involved more than the direct contribution of work. The next question asked participants to indicate the importance of several aspects of participation in group work - contributing work, communicating with group members, remaining up-to-date with the overall status of the project, and providing feedback on the work of other group members. This question utilised a Likert scale, however 'Important' and 'Unimportant' replaced Agree and Disagree. The following two questions required participants to rank aspects of direct and indirect participation, indicating which aspects they found to be the most important. The author recognised that doing so could be difficult for some participants, particularly in the case of direct participation, as all of the aspects listed were highly desirable. Both questions were followed by an open-ended area in which participants could elaborate on their rankings. Had a Likert scale or other form of rating been used for these questions, it is likely that responses would have been almost entirely in the highly positive range, adding little to the research. This is recognised by Krosnick (1999, pp. 555-556), who cites numerous works in stating that ranking questions yield higher-

quality data, are less prone to mistakes, are more reliable, and manifest higher discriminant validity than rating-based questions. Implementing a ranking question forced participants to evaluate each item and consider its importance in relation to the other options. However, ranking questions are much more time consuming and generally more difficult to complete than rating-based questions, and hence they were used sparingly in the questionnaires (Alwin & Krosnick, 1985; Krosnick, 1999; Munson & McIntyre, 1979). Section five ended with two open-ended questions, asking participants what they felt were the most important aspects of participation in group work, and what approaches they had used to judge the participation of group members in prior group work.

The final section, section six, was titled 'Measuring Participation in Online Groupware'. A series of Likert-type questions asked if participants found it difficult to keep track of participation in online group work, if they felt it would be useful to have a better understanding of their group members' participation, and if they felt that it would be useful to know more about passive or unseen actions. The section also asked if participants felt that the quality of contributions was more important than the quantity, and asked how honestly they felt they would rate the contributions of group members both in groupware environments and face-to-face. The section concluded with an open-ended question asking participants what impact they felt a display of group member participation would have in a groupware environment.

An open-ended area gave participants the opportunity for any further comments before submitting the questionnaire. At a length of 46 questions, not including multiple part questions and sub-questions, the author admits that the pre-usage questionnaire was quite long. Great care was taken to encourage its completion; adequate instructions were provided, the questions were clearly phrased, and the interface made answering questions quick and simple. Supplemented by presenting one section at a time, the author feels that the length of the questionnaire was managed as well as possible.

### 3.4.3 Post-Usage Questionnaire

The post-usage questionnaire was made available to participants towards the end of their expected usage period, typically a week or two in advance of the due date of their group project. While the length of the usage period varied between participating units due to the duration of group projects, the author feels that all participants had adequate time using GroupShare and were exposed to the participation awareness mechanism for long enough to answer the post-usage questionnaire. The post-usage questionnaire was administered in the same way as the pre-usage questionnaire – online, with links available from GroupShare. Wherever possible, the author visited participating units towards the end of their usage period to announce the availability of the post-usage questionnaire, respond to any questions regarding GroupShare or the research, and thank students for their participation. When this was not possible, the teaching staff was asked to make mention of it. Towards the end of each semester, a reminder e-mail was sent out to participants who had not completed the post-usage questionnaire.

The post-usage questionnaire consisted of five sections (Table 3.2). As the primary data source of the research, the post-usage questionnaire aimed to explore the participants' thoughts, experiences and perceptions of the participation awareness mechanism in GroupShare. It also sought to gather data regarding GroupShare as a groupware application. The full post-usage questionnaire can be found in Appendix I.

*Table 3.2 – Sections of the post-usage questionnaire*

Section #	Section Title
1	General Group Work & GroupShare Usage
2	General GroupShare Feedback
3	Participation Awareness – General Feedback
4	Participation Awareness – Presentation Styles
5	Participation Awareness – Actions & Metrics

The first section of the questionnaire, 'General Group Work & GroupShare Usage', began by asking participants about the frequency and duration of their GroupShare usage, and any notable usage spikes or lulls their group experienced during the usage period. The section also asked how often they had face-to-face contact with their group members, the frequency of any other forms of contact, and finished with an



open-ended area for any further comments regarding their or their group’s GroupShare usage.

Section two, ‘General GroupShare Feedback’, sought feedback on GroupShare as a groupware application, inclusive of but not in particular relation to the participation awareness mechanism. Likert-type questions asked participants if GroupShare made their group work easier to manage, if the interface was effective, if it made communications easier and if they felt it had an overall positive effect on their group’s performance and outcomes, amongst other questions. The section concluded with three open-ended questions, asking participants to identify which aspects of GroupShare they liked the most, which ones they liked the least, and make any suggestions for improvement. In addition to requesting feedback regarding GroupShare for further research and development of the application, this section aimed to gather data which could confirm that GroupShare was a suitable application in which to conduct research into participation awareness.

The third section was named ‘Participation Awareness – General Feedback’. It advised participants to answer questions from a general perspective of the mechanism, as questions relating to the different presentation styles would follow in the next section. Reproducing the structure of the previous section, section three consisted of a series of Likert-type questions followed by open-end questions. As these questions are central to the research, they have been fully reproduced below in Table 3.3. All questions utilised the standard five-point Likert scale described previously.

*Table 3.3 – Section 3 of the post-usage questionnaire (‘PA feature’ refers to the participation awareness mechanism)*

<b>Q#</b>	<b>Question</b>
18	I placed a significant amount of importance on the PA feature
19	I feel that the PA feature accurately reflected my participation in the group
20	I feel that the PA feature accurately reflected the participation of other group members
21	I found that the PA feature encouraged me to be more active in the group
22	I found that the PA feature encouraged me to work harder
23	I found that the PA feature helped me to understand my group members
24	I found that the PA feature made group work more stressful
25	I found that the PA feature made group work more competitive
26	The PA feature made it easier to keep track of how much group members were participating
27	Overall, I found the PA feature made group work more enjoyable
28	Overall, I found the PA feature to have a positive effect on the group

Section three closed with two open-ended questions, asking participants to identify the positive and negative impacts of the participation awareness mechanism.

As section four, 'Participation Awareness – Presentation Styles', concerned the presentation styles, the introduction to the section contained a link to a page containing examples and descriptions of each style (Figure 3.6). This was to refresh the memory of participants who may not have used some styles heavily, or had not used GroupShare in some time.

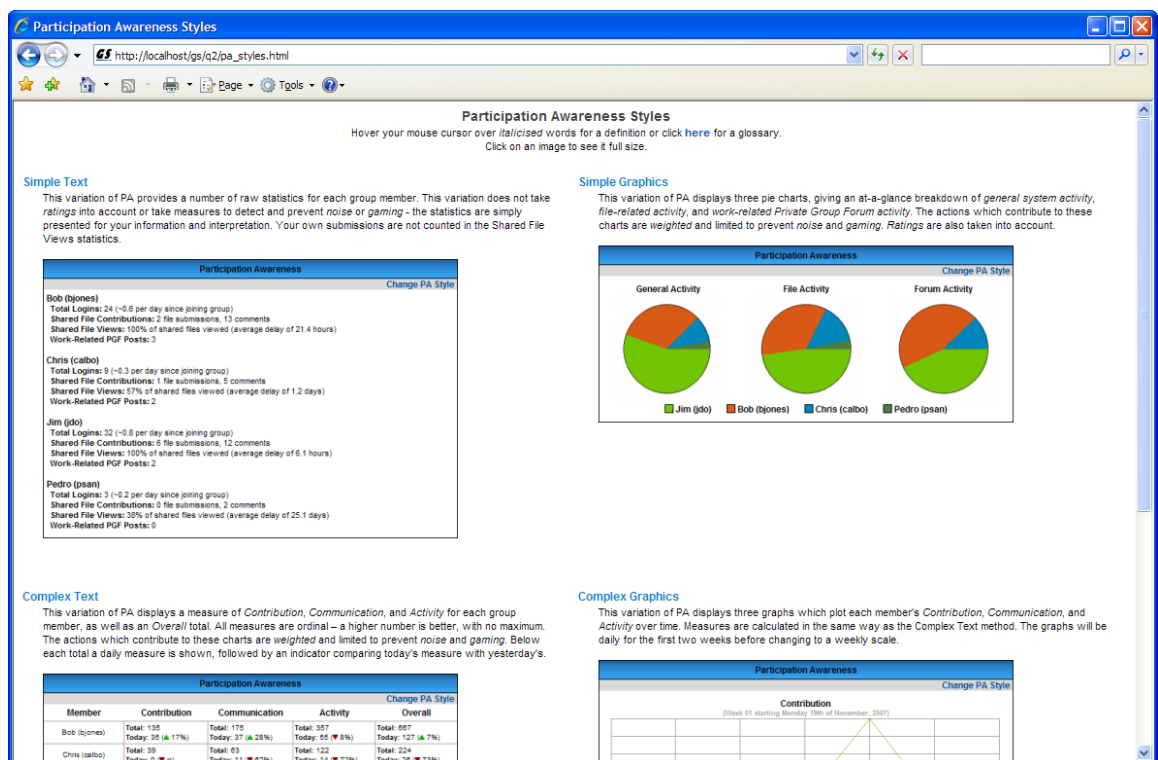


Figure 3.6 – Web page containing examples and descriptions of presentation styles

The first question in the section asked participants to identify how frequently they switched between the different presentation styles. This was followed by three questions in which participants needed to nominate which style they felt provided the best at-a-glance information, the most useful information, and which style was the most visually appealing. The next two questions required participants to rank the four styles from most to least preferred and most to least accurate. As with previous ranking questions, open-ended areas were available should participants wish to elaborate on their rankings. Ranking was utilised in these two questions as they were of key importance to the evaluation of the styles, and hence the extra detailed

captured via rankings was desired. Ranking was not utilised in the previous three questions as completing a ranking question takes more time and effort, hence their use was limited to where they were most beneficial (Krosnick, 1999, p. 555). The section concluded with an open-ended area for further comments regarding the styles or the presentation of participation awareness in general.

Section five was the final section of the post-usage questionnaire, entitled 'Participation Awareness – Actions & Metrics'. The first question asked participants if they had read the information about the participation awareness mechanism that was available in GroupShare, such as its topic in the help or the glossary of terms. A series of Likert-type questions followed, asking participants if they had a reasonable understanding of how the mechanism worked, if they felt that the actions influencing it were appropriate, and if any actions influenced the mechanism more or less than expected. An open-ended area allowed participants to specify which actions had unexpected amounts of influence, if needed. The section also asked participants if they made an effort to rate the files/forum threads of their group members and if they felt the ratings should have a larger impact on the participation awareness mechanism. The final two Likert-type questions asked if knowing that the mechanism relied primarily on quantity over quality influenced their perception of its accuracy, and if they feel that the mechanism reflected the overall quality of their group members' participation. The final question was an open-ended area for further comments regarding the actions and metrics of the participation awareness mechanism.

As with the pre-usage questionnaire, an open-ended area for comments was available prior to submission of the questionnaire. While the post-usage questionnaire totalled 47 questions, it contained less multiple-part questions and sub-questions, which resulted in it being marginally shorter than the pre-usage questionnaire. Regardless, the length was managed in the same manner – via an efficient interface, clear instructions and questions, and the presentation of one section at a time. There is a degree of commonality between certain questions within and between the questionnaires, facilitating comparisons between participant responses. These are examined in Chapter 4.

### 3.4.4 Staff Questionnaire

The staff questionnaire was made available to the university teaching staff lecturing the units which participated in the research. Teaching staff were asked to complete the questionnaire towards the end of their unit's usage period, and a reminder e-mail was sent towards the end of each semester. As the requests to complete the questionnaire came during busy times – the end of a unit's group-based work and the end of semester – the author endeavoured to keep the questionnaire simple and concise. As it was probable that some teaching staff had not found a need to utilise GroupShare themselves, the majority of questions remained general, concerning group work. The staff questionnaire contained three sections (Table 3.4), and was envisaged as a minor supporting data source with a small number of respondents. The full questionnaire can be found in Appendix J.

*Table 3.4 – Sections of the staff questionnaire*

Section #	Section Title
1	Participation in Prolonged Group Work
2	Participation Awareness
3	Aspects of Participation

The first section of the staff questionnaire was titled 'Participation in Prolonged Group Work'. The questionnaire defined prolonged group work as spanning across several weeks or months, and asked teaching staff to respond based on their experiences in units they lecture. Likert-type questions asked teaching staff if students preferred group work to individual work, if students often used online methods to complete group work even when studying on campus, if the staff member found it difficult to have a good understanding of individual student participation during group work and while assessing group work. Teaching staff were also asked if they usually only heard about a problem within a student group when one of the members came to them regarding it. The Likert-type questions were followed by open-ended questions which asked what measures the staff member had in place to ensure student participation during group work, and what measures they used to check student participation after its completion. The final question of the section was also open-ended, asking what factors the staff member used to form an initial perception of a student's participation in group work.

Section two was titled 'Participation Awareness', and concerned the inclusion of a participation awareness mechanism in a groupware environment such as GroupShare. As it was likely that the teaching staff had last seen the mechanism during the application demonstration at the beginning of the usage period, a link to a page (Figure 3.6, above) containing examples and descriptions of the participation awareness styles was available in this section. The section asked if the staff member felt that a participation awareness mechanism would benefit them in assessing student participation in group work, and if they felt that it may have a negative impact on some groups/individuals. An open-ended area was available to clarify the response to this question. The questionnaire then asked if the staff member felt that participation awareness would encourage students to be more active in their group, and if they felt the feature would benefit students overall. Next, the questionnaire asked teaching staff if they had used GroupShare's staff interface to view student groups during the usage period, and if so, whether they found the participation awareness mechanism easy to understand and whether it reflected their own perceptions regarding the participation of students. The section ends with a Likert-type question asking teaching staff if they would like to use GroupShare to support group work in the future, and an open-ended question asking them to summarise any feedback students provided regarding GroupShare or the participation awareness mechanism.

The final section, 'Aspects of Participation', resembled section five of the pre-usage questionnaire, beginning with a Likert-type question asking teaching staff if they believed that indirect participation was an important part of group work. This was followed by a question asking teaching staff to indicate the importance of four different aspects of group work using a Likert scale – a parallel to a question in the student pre-usage questionnaire. Next was an open-ended question asking teaching staff to list what they felt were the most important skills or qualities for students to demonstrate when participating in group work. The final questions concerned student complaints in regards to group work, asking the staff member to indicate the frequency of common complaints – lack of timely contribution, lack of communication, low quality contribution, and group members failing to remain up-to-date with the project. An open-ended area allowed teaching staff to list any other complaints they received in regards to group work.

### **3.4.5 Semi-Structured Interviews**

To support the questionnaires and provide further qualitative data, semi-structured interviews were conducted on a small sample of student participants, and teaching staff lecturing participating units. Student participants were able to indicate their willingness to be interviewed on the consent form and in the post-usage questionnaire. Interviews were arranged via e-mail and conducted towards the end of semester. Being semi-structured, the interview scripts contained a relatively small number of questions, each with possible probes and sub-questions to be utilised as the progress of the interview dictated (Babbie, 2004, p. 266; Nachmias & Nachmias, 1981, pp. 197-200). Both interviews consisted of two main sections, the first concerning group work and GroupShare usage, and the second concerning the participation awareness mechanism. For both interviews, a page of terminology and definitions was on hand, should anything need clarification, and printed examples of the participation awareness presentation styles were also available, should the interviewee wish to view them. The student and staff interview scripts can be found in Appendices K and L.

The first section of the student interview script began by asking about what GroupShare was used for and how often it was used. It then asked how the group work experience compared to previous group work experiences, if it was more pleasant than originally anticipated, and if the interviewee felt that this was influenced by using GroupShare. Also covered was discussion of several features of GroupShare, and issues relating to or arising from face-to-face contact outside of GroupShare. The staff interview asked how students responded to the unit's group work requirement, how they responded to using GroupShare, how frequently the staff member saw students working in GroupShare and how well the students performed compared to previous semesters. Probing questions explored whether the staff member felt that this was influenced by the use of GroupShare. The section also covered the teaching staff's usage of GroupShare's staff interface and any suggestions to improve the application.

The second section of the student interview script covered the participation awareness mechanism, asking the interviewee if it influenced the way they worked, if anybody in

their group attempted to manipulate it, and if they felt that any actions did not influence the mechanism as expected. The interview then addressed the issue of quantity versus quality, asking the interviewee if it influenced how they felt about the participation awareness mechanism. Discussion of the impact of ratings and the different presentation styles followed, before the interview concluded by asking the interviewee if they had any further thoughts or issues to raise. In the staff interview, the second section began with the presentation styles, asking which one the interviewee found the most visually appealing, which one they thought would be the most useful to students, and which one they thought provided the most useful information for staff viewing student participation. The section also discussed the issue of quality versus quantity, and the potential for using the participation awareness mechanism to assist in the assessment of student participation in group work.

While parts of the interviews bore similarities to the questions asked in the questionnaires, care was taken to minimise repetition. Interview questions and topics sought further information and details, or addressed issues covered in the questionnaires from a different perspective.

### **3.4.6 Log-Based Observation**

Observation was achieved in the research via the recording of user interactions with GroupShare in the form of logs. The log-based observation was an entirely autonomous and unobtrusive process, ensuring that it did not influence participants or introduce bias, as other methods of observation are known to do. Such logging is standard in most applications, with logs playing a key role in system auditing and responding to security threats and often being employed in features throughout an application (J. Brown & Baatard, 2008; Price, 1997; Scarfone & Mell, 2007). The participation awareness mechanism in GroupShare utilises the logs gathered by the application as its data source. Figure 3.7 shows some logs, as gathered by GroupShare. The logs are stored in a table of a relational database, and feature relationships to values in other tables – For example the ‘action\_type’ field is linked to a table containing the number of Contribution points, Communication points and Activity points associated with each type of action (the content of this table has been

reproduced in Table 3.6). The 'action' field in the figure contains HTML code that GroupShare uses to provide a description of the action, and a link to the object the log relates to, where appropriate.

action_id	enrolment_id	action_type	action	object_id	time
16294	13	login	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 22:58:24
16295	13	view_home	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 22:58:24
16296	13	view_file	<acronym title="View User Profile" onclick="javascript: pare	178	2008-03-28 22:58:26
16297	13	download	<acronym title="View User Profile" onclick="javascript: pare	178	2008-03-28 22:58:28
16298	37	login	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 22:59:04
16299	37	view_home	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 22:59:04
16300	13	comment	<acronym title="View User Profile" onclick="javascript: pare	178	2008-03-28 22:59:13
16301	12	login	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 23:41:52
16302	12	view_home	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 23:41:53
16303	12	post_message	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 23:43:05
16304	12	view_file	<acronym title="View User Profile" onclick="javascript: pare	174	2008-03-28 23:43:30
16305	12	view_home	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 23:43:37
16306	12	chat_login	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-28 23:43:42
16307	16	view_home	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-29 00:02:14
16308	16	view_home	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-29 00:58:36
16309	66	view_home	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-29 01:48:39
16310	66	post_message	<acronym title="View User Profile" onclick="javascript: pare	0	2008-03-29 01:49:28
16311	66	view_thread	<acronym title="View User Profile" onclick="javascript: pare	36	2008-03-29 01:49:39

Figure 3.7 – A sample of logs recorded by GroupShare

The logs gathered by GroupShare are integrated with the rest of the relational database, with the 'enrolment\_id' field linking to a table containing a 'group\_id' field and a 'user\_id' field. The user\_id field links to a unique user account in GroupShare, while the group\_id field identifies a unique group, which is then linked to a table containing unit details. The relationships between tables is depicted in Figure 3.8. Not depicted in this figure is the 'object\_id' field of the logs table, and its relationship to either a file or a forum, depending on the action\_type of the log.



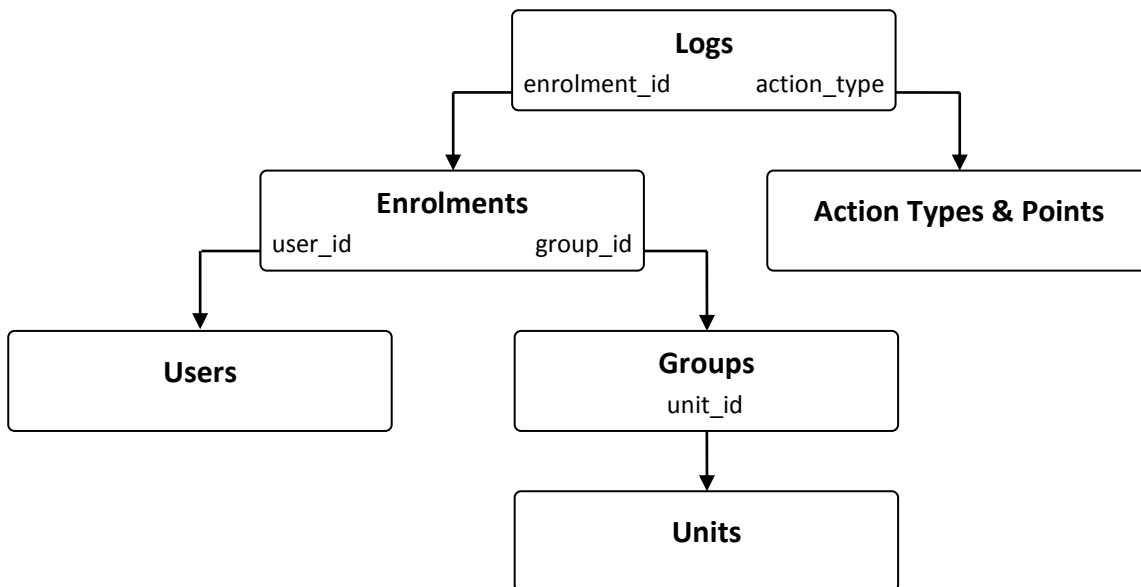


Figure 3.8 – Relational database structure of GroupShare logs

The relational structure behind the logs allows them to be queried to produce valuable statistical information in a variety of scopes. Statistics can be drawn from the logs pertaining to anything from the total activity in GroupShare or an entire unit, to single groups or users. The unobtrusive nature of log-based observation was in conjunction with the author’s efforts to remain unobtrusive throughout the research, allowing participants to utilise GroupShare to complete their unit-based group work and interact with the participation awareness mechanism in a natural context, with minimal reminders of the research at hand. The logs serve as a valuable supplementary data source, which are utilised in numerous areas of analysis. The term ‘usage data’ is used to refer to this data source.

The methods employed were intended to provide a rich set of data, using multiple sources and incorporating both quantitative and qualitative elements. All data collection techniques within the field study methodology were designed to minimise any disruption to the natural context of the participants. Care was taken to ensure questionnaires and interviews were effectively written and implemented. The research design employed multiple groups, units and instances of study, increasing validity and resulting in a richer set of data.

### ***3.5 Validity of the Research Methodology and Design***

Internal validity is a crucial factor in experimental research, where the aim is typically to find causal relationships in order to prove or disprove a hypothesis. The research must be designed and conducted in such a way as to ensure that any relationships discovered between independent and dependent variables actually exists, and is not caused or influenced by other variables (Adams & Schvaneveldt, 1991, pp. 135-145; Babbie, 2004, p. 230; Nachmias & Nachmias, 1981, pp. 58-61). This research employed a field study methodology that aimed to develop a model of participation awareness – the research questions revolving around ensuring that such a model is accurate and effective, rather than attempting to evaluate the impact of participation awareness. As a model inherently aims to be generically applicable, external validity is of higher relevance to this research.

External validity refers to the extent to which the findings of a piece of research can be generalised to the population from which the research sample was drawn (Adams & Schvaneveldt, 1991, pp. 89-90; Nachmias & Nachmias, 1981, pp. 92-93; Trochim, 2006). The external validity of experimental research is sometimes criticised, as it is conducted in a heavily controlled and artificial environment, the results of which may not be generalisable to real-life settings. By preserving the natural setting, field-based research can produce results with higher external validity (Adams & Schvaneveldt, 1991, p. 260; Nachmias & Nachmias, 1981, pp. 93, 125-127). In this research, participants were working to complete standard university group work. The formation, duration and activities of groups were not influenced by the research, and nor could they be considered extreme or unusual. The groupware environment in which they worked was designed to offer generic features and functionality, the likes of which students often seek out themselves in order to support group work. The data collection methods employed were as unobtrusive as possible, with all direct forms of research interaction (questionnaires and interviews) occurring at the beginning and end of the usage periods. All of these factors serve to preserve the natural setting of the research, heightening the external validity of its findings.

The representativeness of the research sample also influences external validity. If research is conducted on a sample that cannot be said to represent its population accurately, then it is less likely that results of the research will be generalisable to the population (Adams & Schvaneveldt, 1991, p. 94; Nachmias & Nachmias, 1981, pp. 92-93). While the participants of this research were drawn primarily from a single university department (see Section 3.3.2), it included suitable demographic diversity in areas such as age, gender and group work experience (see Section 4.5 and Section 5.5). Furthermore, as online group work is not prevalent throughout all areas of education and enterprise, sampling from a population where it *is* prevalent – in this case, the department of the university focused upon areas of computer science – was deemed the most appropriate approach. GroupShare was presented as a useful tool to support group work, minimising the possibility of sample bias being introduced via voluntary participation (Nachmias & Nachmias, 1981, p. 92) by giving students a personal motive to participate. The group work completed by the participants was typical of group work in education and enterprise, involving such tasks as authoring a lengthy document and completing a group project and its documentation. The author feels that the sample was representative of a population likely to engage in online group work, but concedes that it may be marginally less representative of enterprise environments than educational ones due to the context of the research.

Finally, the author feels that the external validity of the researched was enhanced via repetition. Multiple instances existed of each unit of analysis (Babbie, 2004, pp. 94-100) in the research – individual participants, groups, units and iterations of the research data collection as a whole. Each instance was of course unique and produced different data, however the analysis of this data produced consistent and homogenous findings. Had the research employed a methodology such as a case study where a single or small number of participants and groups were investigated, any findings would have been closely tied to the context and dynamics of those cases. Employing a research methodology and design which included multiple instances of all units of analysis produced findings which were generalisable within the sample, and hence are more likely to be generalisable to a greater population.

## ***3.6 The GroupWare Environment***

### **3.6.1 GroupShare Overview**

In order to address the research questions appropriately and produce a participation awareness model that is generically applicable, research must be conducted in an environment which is itself generic. The methodology and design of the research places it in what can be considered a typical group work scenario – learners working in groups as part of their university studies. The composition, formation, duration and activities of the student groups were in no way extreme, and suitably represented group work in both education and enterprise (Boud et al., 2001; Gibson & Cohen, 2003; Thorley & Gregory, 1994). It is necessary that the groupware application utilised in the field study be generic, in order to minimise the potential influence of any particular software environment upon the data collected. In addition to providing a generic set of features, the usability of the groupware application was of high importance in minimising the impact of the environment upon participant activity and response:

The usability issue has long been recognized as an important aspect in the design of computer systems. In groupware it can have a strong impact both on the overall efficiency and effectiveness of the team, and on the quality of the work they do. (Antunes, Borges, Pino, & Carriço, 2006, p. 31)

This section provides an overview of GroupShare, the groupware application developed by the author to house the participation awareness mechanism for the research. It is worth noting that while some elements of GroupShare are named in accordance with the university context of the research, for example groups exist within ‘units’, the application was not designed to be exclusive to educational environments. With the renaming of a small number of terms, GroupShare would be equally appropriate in an enterprise environment.

The literature suggests taking into account the nature of collaboration when designing groupware applications and the awareness mechanisms they employ (Churchill & Wakeford, 2001; Gutwin & Greenberg, 1996; Pinelle et al., 2003; Pinelle & Gutwin, 2003), and hence GroupShare is tailored towards loosely-coupled asynchronous

collaboration. As detailed in Section 2.3, this type of collaboration is the most relevant to the exploration of a participation awareness mechanism, and typifies the nature of collaboration undertaken by the research participants and others working in similar contexts (J. Clark, 2000; Grudin & Poltrock, 1997; Tam & Greenberg, 2006). This has resulted in a groupware application which allows users to work somewhat independently, sharing work and communicating when necessary. The awareness mechanisms implemented in GroupShare aim to inform users of any activity since their last visit, rather than providing up-to-the-minute information on the current activities of other users.

GroupShare was developed by the author over a six-month period between the approval of the proposal for this research and the pilot study. It is a Web-based groupware application, designed to be as centralised, flexible and generically applicable as possible, and to provide a rich set of awareness mechanisms (Baatard, 2008). It can be accessed via a standard Web browser, and does not require any plug-ins or helper applications. GroupShare is compatible with a range of browser software and has low bandwidth and processing requirements. Registration into the application is a simple process of providing some basic information and selecting a group (Figure 3.9) – users may join multiple groups, but only one per unit. Once registered, access to GroupShare is granted via the username and password provided during registration. A help system is available, explaining each feature of the application. It is accessible via a link in the footer of each page of the application, or by double clicking the title bar of a feature in the interface. An e-mail link to contact the system administrator, the author of this research, is available in the footer of each page.

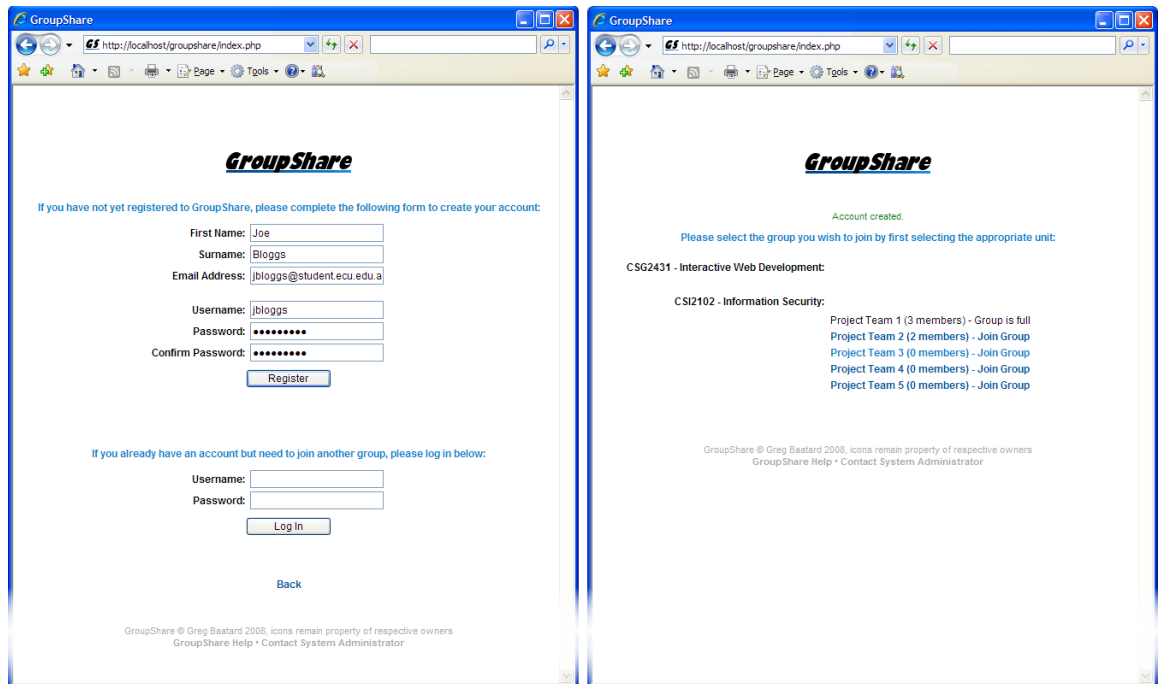


Figure 3.9 – Registering an account (left) and joining a group (right) in GroupShare

Upon logging in, users are taken to the 'Group Home' page (Figure 3.10). This is the primary page of GroupShare, the nexus that provides information and access to most of the application's features. The four main elements of this page are 'Group Files', providing information and access to files which have been shared within the group, a simple 'Message Board' for the posting of short messages to the group, a 'Recent Activity' area implementing activity awareness (Borges et al., 2000; Jang et al., 2000; Kirsch-Pinheiro et al., 2003; Preguiça et al., 2000; Steinfield et al., 1999) and the participation awareness mechanism.

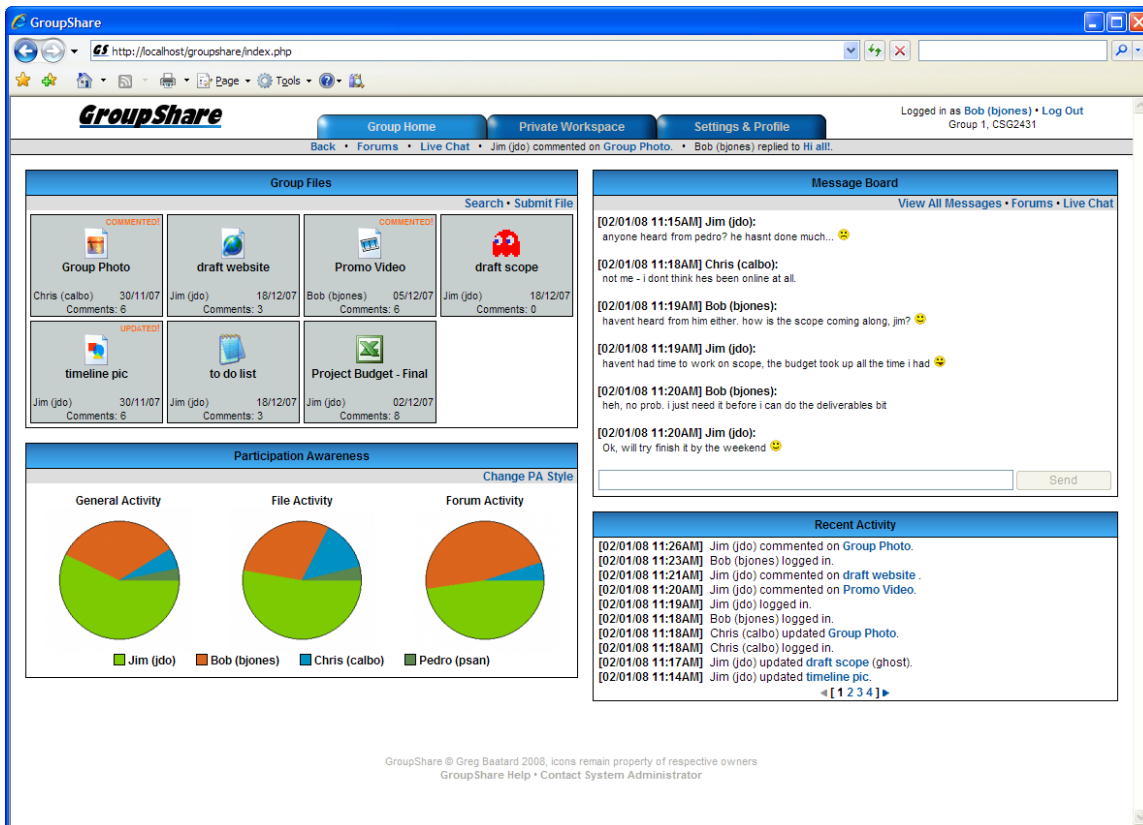


Figure 3.10 – GroupShare’s Group Home page

Remaining consistent across the top of each page are tabs providing access to the Group Home page, the ‘Private Workspace’ page, and the ‘Settings & Profile’ page. The Private Workspace page allows users to manage the files they have uploaded, take private notes, and send, receive and read private messages to other group members. The Settings & Profile page allows users to customise various aspects GroupShare to suit their personal preferences, and complete a profile of information about themselves which can be viewed by their group members. Amongst the preferences is the ability to customise the types of events and timeframe reported by the activity awareness mechanism. While the personal profiles contain some socially oriented fields such as nickname and a short biography, most of the fields concern task-related information such as skills, strengths and talents. This is in accordance with the findings in Baatard (2007b), where participants expressed a strong preference for task-related information over socially oriented information in profiles within learning environments.

File sharing is the central collaborative element of GroupShare, allowing users to upload any file and make it accessible to their group members (Figure 3.11). This is a core component of most groupware applications, and was chosen above in-system content creation (as typified by a wiki) as it allows users to create content in the applications they are accustomed to, reducing the cognitive load associated with the groupware application. Furthermore, while in-system content creation is quite simple and effective when the content is text-based, it is less so when the content includes various data types such as images, sounds, executable applications and programming code. In light of these issues, it was felt that a groupware application implementing in-system content creation would lessen its generic applicability.

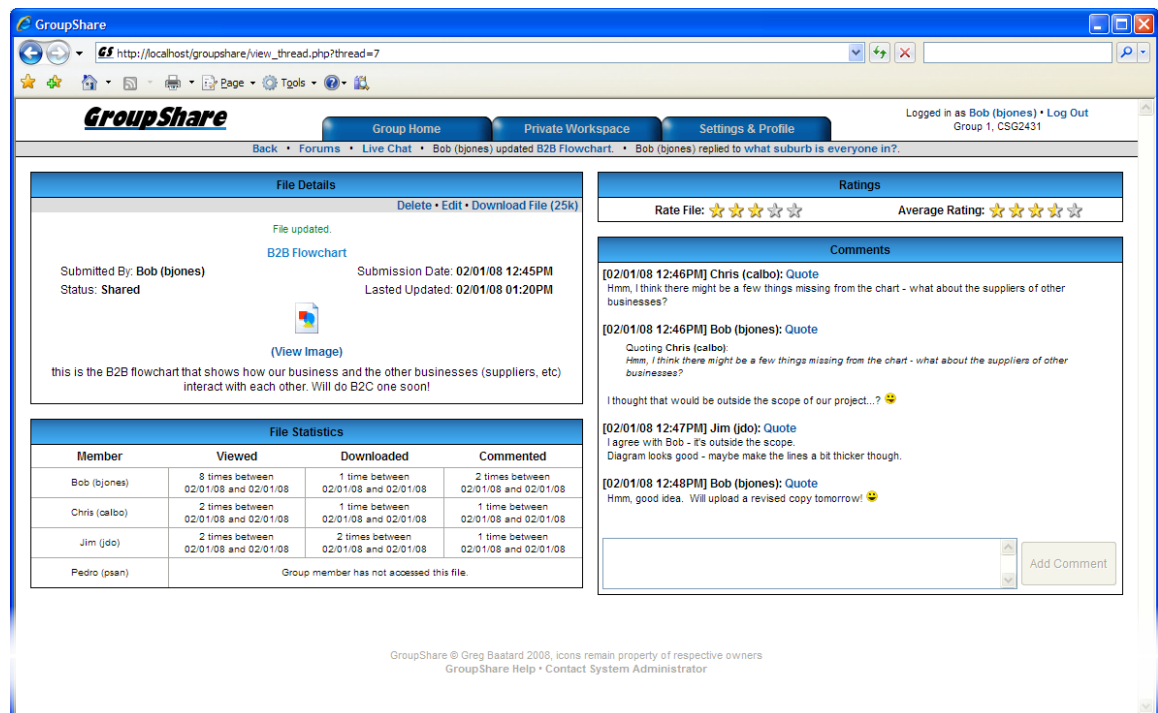


Figure 3.11 – Viewing a shared file in GroupShare

Files of any type up to a size of 25 megabytes can be uploaded, and require a title to uniquely identify it to the group, and a status to be selected. The status of a file can be either 'Shared', which allows it to be accessed by other members of the group, or 'Private', which submits the file to the user's Private Workspace. Optionally, a description can be entered to provide any further information about the file, and a list of keywords can be entered, to assist in searching for the file. Shared files can be viewed by other group members, who can then download the file, comment on it, or



give it an anonymous rating. The content of text, image or programming code files can also be viewed in GroupShare itself, rather than requiring users to download and then open the file. Statistics of how often and when each member of the group has viewed, downloaded and commented on each file are also displayed. This simple awareness mechanism aims to increase users' understanding of how files have been received and utilised by their peers. Making such data available increases context-awareness, which Brézillon, Borges, Pino and Pomerol (Borges et al., 2005; Brézillon et al., 2004a, 2004b) have found to be an important factor in the efficacy of awareness and online collaboration as a whole.

GroupShare offers numerous means of communication. In addition to the Message Board, private messaging and commenting on shared files, users have access to a number of threaded discussion forums (Figure 3.12). A private discussion forum is available for each group, and forums with a larger scope of access can be created as needed. In this research, this the author implemented unit-based forum for each participating unit, and a general forum accessible by all GroupShare users. The provision of multiple discussion forums of different scope is recommended in J. Clark (2000). Threads in the private group forum can be labelled by their creator as work-related or social, and it is only the work-related threads in this forum that have an impact on the participation awareness mechanism – social threads or posts in other forums do not influence the participation awareness mechanism. As with shared files, private discussion forum threads can be anonymously rated.

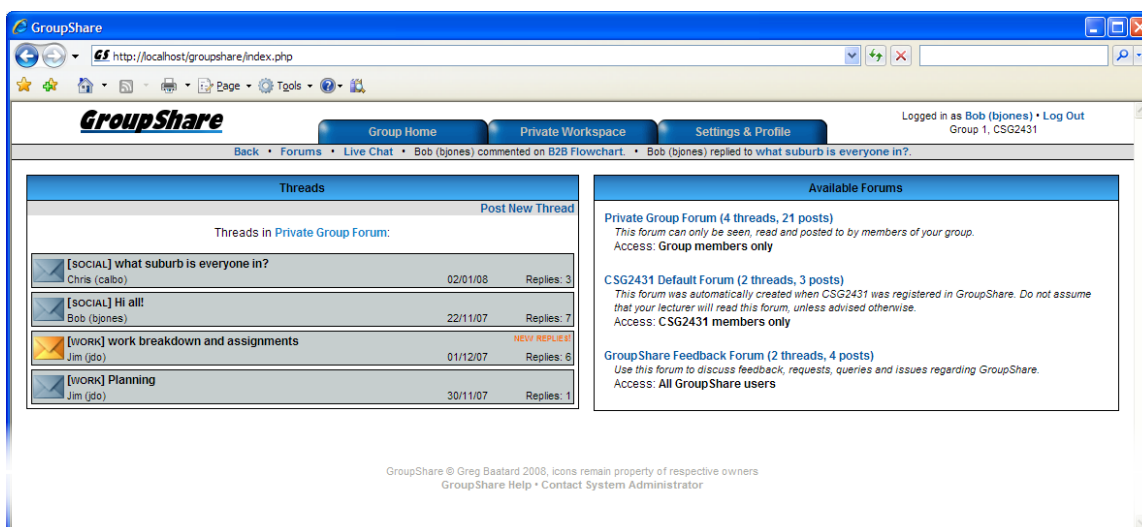


Figure 3.12 – Viewing a discussion forum in GroupShare

GroupShare also features a synchronous ‘Live Chat’ feature (Figure 3.13). While GroupShare is designed to facilitate asynchronous collaboration, a synchronous communication method was still deemed to be essential, to facilitate rapid discussion, feedback and decision-making. A synchronous chat facility was implemented in a similar groupware application described in Jang, Steinfield and Pfaff (2000), who noticed that “teams floundered without real-time communication” (p. 28). This view is supported by the findings of Stacey (Stacey, 2000), who, in examining collaborative learning in Web-based environments, stated that “the need to communicate in a synchronous way was raised by all students ... This seemed to enable them to establish social presence and group cohesion and is an important factor to be considered in establishing online courses” (p. 944).

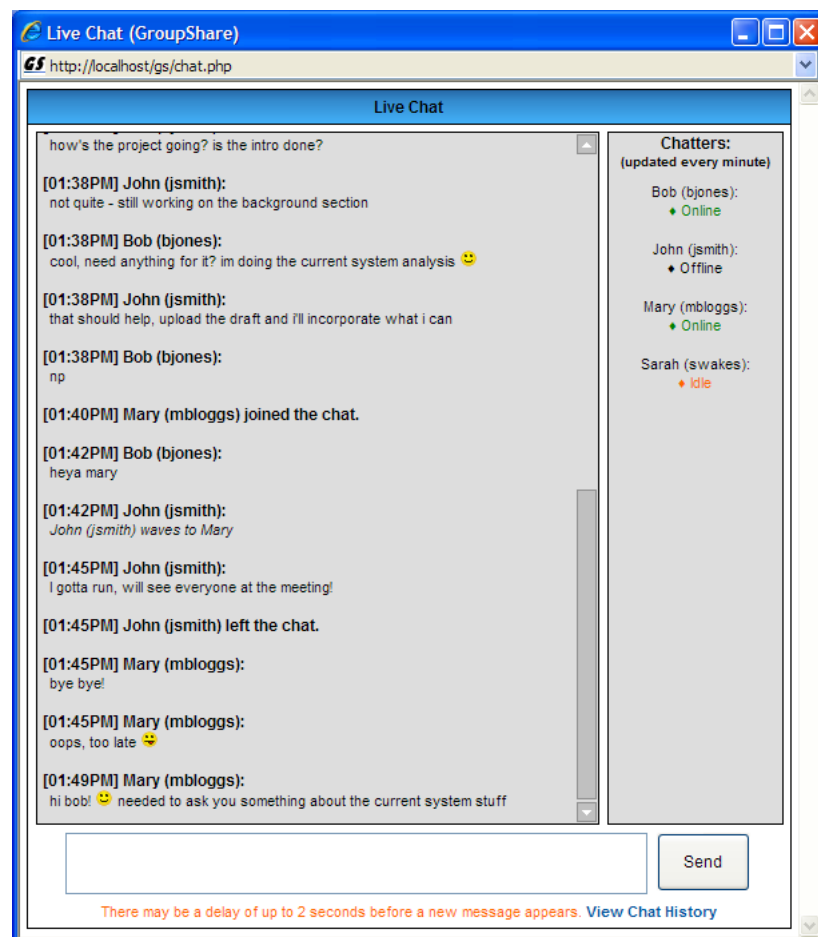


Figure 3.13 – GroupShare’s Live Chat feature

The final feature of note in GroupShare are ‘trophies’, which take the form of small images (Figure 3.14) that are awarded to users for participation-related events and milestones. Trophies are displayed in a user’s profile, providing other group members

with an at-a-glance impression of how active the user has been. While this feature serves as an awareness mechanism, its primary intent is to encourage users to be active by rewarding sustained participation and contribution in a publicly-noticeable manner – a technique often implemented in online discussion forums or communities (Cheng & Vassileva, 2005).



Figure 3.14 – Trophies as displayed in a user’s personal profile in GroupShare

GroupShare features two levels of administrative access. A staff interface was available to teaching staff delivering participating units, allowing them to manage group enrolments in their unit, manage and participate in discussion forums, and view any group registered within their unit. Viewing a group functions as read-only access to the group as it would be seen by a group member. An administrative interface, accessible only to the author and research supervisor, allows the creation and management of units, groups and discussion forums, the management of group enrolments, and the creation of announcements. Announcements can be made to individual units or all units, and appear in the Message Board of GroupShare. The administrative interfaces allow GroupShare to be managed effectively, and give teaching staff adequate control of their unit’s GroupShare usage.

“Fundamentally, the [online collaboration] tools all offer these basic services: a way to communicate, a mechanism to share documents, some means to discover other members of the community” (Fichter, 2005). By implementing the communicative, collaborative and awareness features that typify groupware aimed at loosely-coupled asynchronous collaboration, GroupShare is designed to be a useful and generic groupware application. Furthering this, the interface is straightforward and intuitive, and the hardware, software and network requirements are low, minimising the

cognitive load and accessibility issues associated with introducing a piece of software. Figure 3.15 summarises and categorises the features of GroupShare.



Figure 3.15 – Categorized summary of GroupShare features

In justifying the design and features of GroupShare, the author examined the findings of three seminal papers which addressed such topics; those of Appelt and Birlinghoven (2001), Steinfield, Jang and Pfaff (1999) and Mandviwalla and Olfman (1994). Appelt and Birlinghoven (2001) evaluated feature usage in BSCW, a Web-based groupware application with similarities to GroupShare, in order to determine which features users actually used. Following the predictably large proportions of viewing, reading and downloading objects, the three most frequently performed actions were “getting meta-information about objects”, “creation (upload) of documents” and “reading information about events” (p. 340). GroupShare provides meta-information on all files, including both the description and keywords which can be supplied by the user, and the file statistics which are displayed autonomously. File upload is simple and efficient, allowing reasonably sized files of any type to be submitted, and GroupShare provides numerous awareness mechanisms, such as the Recent Activity display, that serve to inform users of events within their group. Hence, GroupShare features effective implementations of the features and functionality which users of BSCW, a similar groupware application, were found to use the most.

Steinfeld, Jang and Pfaff (1999) implemented a groupware application named TeamSCOPE, which focused on very similar design principles as GroupShare, for largely the same reasons. They “attempted to design an integrated collaborative tool which takes into account the varieties of awareness information”, and listed a number of design parameters (p. 85):

- Provide a shared workspace for group members to store and retrieve files.
- Support asynchronous group work via the ability to post group messages.
- Provide group members with ongoing awareness information about activity, communication, files, etc.
- Be accessible over the Internet via a standard Web browser, with no need for plug-ins or software installation.
- Be customisable for different groups.

GroupShare implements these design parameters, and its features share similarities to those of TeamSCOPE. Both applications are designed to provide a centralised, flexible, awareness-rich environment for loosely-coupled group work.

Mandviwalla and Olfman (1994) outlined a number of limitations seen in groupware applications at the time. While dated, the limitations are still applicable to current groupware. Table 3.5 lists the limitations outlined in Mandviwalla and Olfman, and how they are addressed in GroupShare.

Table 3.5 – Limitations of groupware, drawn from Mandviwalla and Olfman (1994)

Groupware Limitation	Limitation Addressed in GroupShare
<b>Group Interaction (Only) Support:</b> Systems support interactive portion of group work, but not individual work.	Users have private workspace in which they can take notes and store files without sharing them with group.
<b>Single-User Perspective:</b> Systems developed from perspective of single (often managerial) user, and hence fail to meet group characteristics.	Developed from general group member perspective. No specialised roles or restrictions within GroupShare. Management interface separate from and unseen by users.
<b>Simplified View of Groups:</b> Systems fail to account for possible negative aspects in collaborative work, or are rigidly structured to direct group work along with unrealistic efficiency.	Multiple awareness mechanisms and anonymous rating feature serve to counter possible negative aspects. Designed for generic applicability, having no structured progress model – not ‘goal-driven’.
<b>Temporal and Locational Variations:</b> Different systems used to support different aspects of group work, resulting in inconveniences such as multiple logins and increased cognitive load.	GroupShare supports numerous collaborative and communicative activities, both asynchronous and synchronous, via a single login. Features and Web-based interface are consistent and easy to use.
<b>Piecemeal Group Support:</b> Systems support or focus upon a subset of common group work tasks and aspects.	GroupShare supports a wide range of group work tasks via a set of generically applicable features. Multiple communication and collaboration avenues.
<b>Implicit Prescriptive Worldview in Design:</b> Systems designed to match worldview of designer, resulting in role-based restrictions which may not be applicable or suitable to user groups.	No specialised roles or restrictions within GroupShare. Generic and flexible features allow GroupShare to be used in numerous manners.

To address these limitations, Mandviwalla and Olfman proposed a set of generic groupware design requirements. Summarised, the requirements suggest that an ideal groupware application should support multiple group tasks, work methodologies and methods of interaction. An ideal groupware application should also accommodate different group contexts and members’ behavioural characteristics. In designing GroupShare to be centralised, flexible and generic, the author feels these requirements have been met.

### 3.6.2 GroupShare’s Participation Awareness Mechanism

GroupShare implements what the author considers to be the first fully-fledged participation awareness mechanism. While previous research by the author (Baatar, 2006) explored and implemented a similar mechanism, it was of a considerably lower level of sophistication and did not embody several of the nuances of the current research. As the first full-fledged implementation of participation awareness, the mechanism present in GroupShare required a significant amount of ‘new ground’ to be covered. In keeping with the research questions, this can be divided into two broad areas – metrics and presentation.

Since this research aimed to develop a generic model of participation awareness which can be implemented in any groupware environment, the assumptions which can be made in regards to the metrics of participation are quite limited. The features of a groupware application or the nature of a collaborative project may make certain actions possible or of greater value, while others may not be feasible or relevant. GroupShare's generic nature allows for a range of common actions which most groupware applications share to serve as metrics. For example, logging in, contributing work, accessing contributed work, providing feedback and communicating with other group members. Records of these actions are routinely recorded by groupware applications in the form of logs, or as part of the application's normal operation. Hence, it is likely that a participation awareness mechanism can be added to an existing groupware application with little need for additional metric-gathering functions. This is evidenced in GroupShare, which despite being designed to include participation awareness from the beginning, does not feature more logging than it would otherwise have done.

With reference to the literature, the author has defined three categories of participation metrics – 'Contribution', 'Communication', and 'Activity' (Baatard, 2007a; Borges et al., 2000; Carroll et al., 2006; Ogata & Yano, 1998). Any participation-related action in a groupware environment that can be autonomously captured falls into one or more of these categories. These categories are not limited to direct contribution towards a collaborative project, because as Borges and Pino (1999) recognised, "A group member might be participating by simply accessing other member's contributions." Hence, it is important that the mechanism encompass both direct and indirect metrics in order to present a holistic measure of participation. In order to associate weight or value to an action performed in GroupShare, each one has a number of Contribution points, Communication points and Activity points associated with it (Table 3.6). For example, submitting a file receives six Contribution points, two Communication points and three Activity points, while commenting on a submitted file receives one Contribution point, two Communication points and one Activity point. Points do not need to be awarded to each category – logging in to GroupShare receives two Activity points, but no Contribution or Communication points. The points awarded for submitting files and creating discussion threads are modified based on the

average rating they have received from other group members. If the average rating is positive (above two and a half out of five) the points are increased to a maximum of double their original values. If the average rating is negative (below two and a half out of five) the points awarded are decreased, to a minimum of forty percent of their original values. Modifying the points awarded based on ratings allows the participation awareness mechanism to incorporate a qualitative element to the otherwise quantitative nature of the mechanism. The number and type of points awarded to each action is based on the context of the research, and the author's prior experience in the group work to be undertaken by participants. They should not be considered prescriptive or generically applicable.

*Table 3.6 – Participation awareness metrics and point allocations in GroupShare*

<b>Metric Name</b>	<b>Metric Description</b>	<b>Cont. Points</b>	<b>Comm. Points</b>	<b>Act. Points</b>
attempted_delete	Attempting to delete a previously uploaded file	0	0	1
chat_login	Logging in to the live chat feature	0	1	1
chat_message	Sending a message in live chat	0	1	1
comment	Commenting on a shared file	1	2	1
delete_file	Deleting a previously uploaded file	0	0	1
download	Downloading a shared file	1	0	1
forum_edit	Editing a discussion forum post	1	1	1
forum_post	Posting a new thread in the discussion forum	4	3	2
forum_reply	Replying to a thread in the discussion forum	1	2	1
login	Logging in to GroupShare	0	0	2
logout	Logging out of GroupShare	0	0	1
post_message	Posting a message on the message board	0	3	2
rate_file	Rating a shared file	1	1	1
rate_thread	Rating a discussion thread	1	1	1
read_pm	Reading a private message	0	1	1
send_pm	Sending a private message	0	2	2
submit	Uploading a file	6	2	3
update_file	Updating a file or its associated metadata	1	1	1
update_profile	Updating a personal profile	0	2	2
update_settings	Updating GroupShare settings	0	0	1
view_file	Viewing a shared file	1	0	1
view_forum	Viewing the discussion forum	0	0	1
view_home	Viewing the Group Home page	0	0	1
view_profile	Viewing another user's personal profile	0	0	2
view_thread	Viewing a discussion forum thread	1	0	1

The final aspect of the participation awareness metrics is that of imposing limits, in order to minimise spam or noise and deter gaming. Spam and noise refer to users performing numerous inane or unnecessary actions, in order to artificially inflate one's standing in the participation awareness mechanism. Gaming aims to achieve similar results, but typically employs a more subtle and sophisticated approach – exploiting imbalances, bugs or oversights in the mechanism rather than the brute force approach



of spam and noise creation. The limits applied in this research were drawn from the author's experience, as no research literature was found that offered guidance regarding suitable limits. They aimed to reach a balance that allowed the mechanism to adequately recognise a high level of participation and GroupShare usage, but prevented the awarding of an excessive number of points for superfluous actions. Similar to the metrics and the points awarded to them, a generic template or list of limits is not feasible. Depending on the environment in which a participation awareness mechanism is implemented, limits may not be needed at all. Alternatively, lower limits could be implemented in order to create an attainable 'maximum participation rate'.

While there is no limit to the number of actions a user can perform, the actions will not influence the participation awareness mechanism, above the imposed thresholds. Limits are applied by frequency over time, and also in relation to an object within GroupShare where appropriate (Table 3.7); a login is limited at three per day, while replying to a forum thread is limited to three replies per thread per day. The core methods of direct contribution, that being the submission of shared files and the posting of work-related private discussion forum threads, were not limited. As these actions are central to the collaborative process, the probability of users attempting to create noise or game the mechanism in this manner was low. Furthermore, superfluous submissions and postings can be rated poorly by group members to minimise their impact on the participation awareness mechanism.

Table 3.7 – Limits applied to participation awareness metrics

Metric Name	Metric Limit
attempted_delete	Maximum of 1 per file per day counted
chat_login	Maximum of 3 per day counted
chat_message	Maximum of 30 per day counted
comment	Maximum of 2 per file per day counted
delete_file	Maximum of 1 per file per day counted
download	Maximum of 1 per file per day counted
forum_edit	Maximum of 1 per thread per day counted
forum_post	Unlimited
forum_reply	Maximum of 3 per thread per day counted
login	Maximum of 3 per day counted
logout	Maximum of 3 per day counted
post_message	Maximum of 4 per day counted
rate_file	Maximum of 1 per file per day counted
rate_thread	Maximum of 1 per thread per day counted
read_pm	Maximum of 4 per day counted
send_pm	Maximum of 2 per day counted
submit	Unlimited
update_file	Maximum of 1 per file per day counted
update_profile	Maximum of 1 per day counted
update_settings	Maximum of 1 per day counted
view_file	Maximum of 2 per file per day counted
view_forum	Maximum of 3 per day counted
view_home	Maximum of 5 per day counted
view_profile	Maximum of 2 per day counted
view_thread	Maximum of 2 per thread per day counted

The second supporting research question concerns the effective presentation of participation awareness. To study this, GroupShare’s participation awareness mechanism implemented four distinct presentation styles – two textual and two graphical. Each represents participation awareness in a different manner, and while there are minor differences in the way metrics data is processed in each style, the metrics used are the same. Users can switch between the different presentation styles at will, and a description of each is provided (Figure 3.16). Regardless of the currently selected style, the participation awareness mechanism is always displayed in the lower left quarter of the Group Home page.

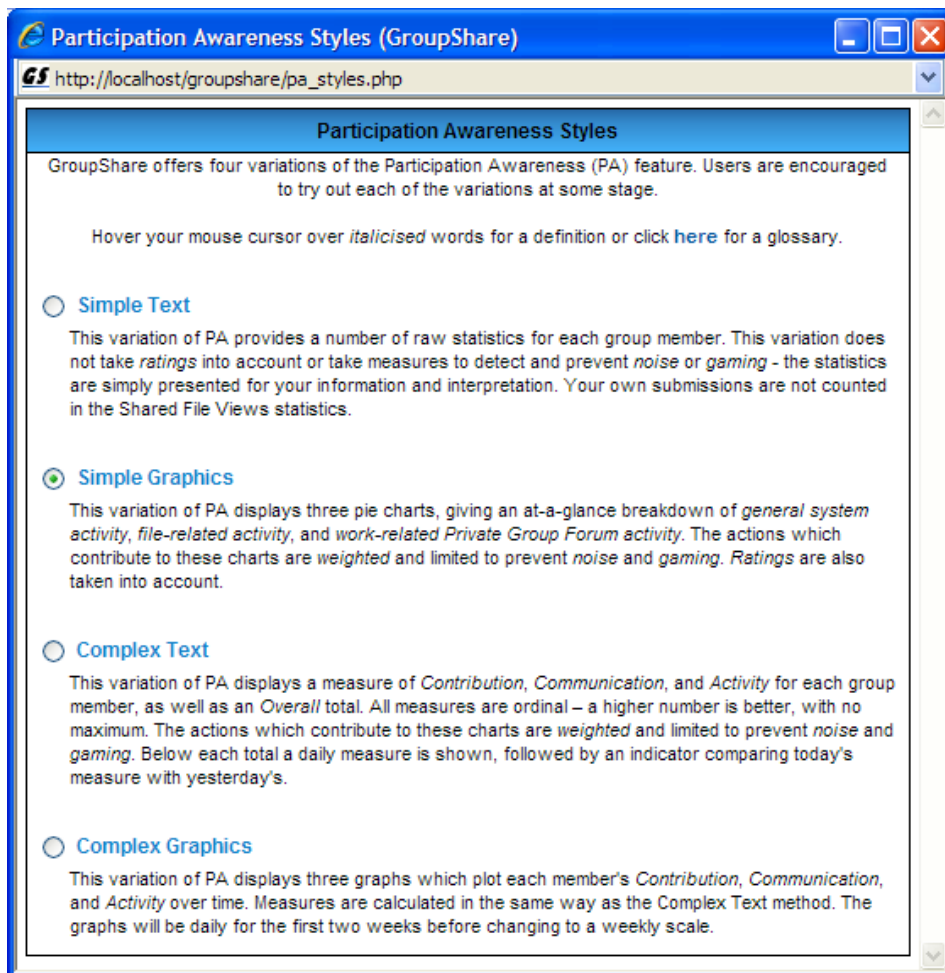


Figure 3.16 – Presentation style switcher and descriptions in GroupShare

The default style is named ‘Simple Text’, and presents participation awareness as a set of raw statistics regarding key actions in GroupShare (Figure 3.17). The use of raw statistics is in response to prior research by the author (Baatard, 2006), in which a number of participants indicated that too much abstraction and processing of the participation awareness metrics made it difficult to interpret the mechanism in a meaningful manner. The Simple Text style minimises the potential for ambiguity, and emphasises the need for users to interpret an objective measurement in a subjective way. While some of the statistics could no doubt be deduced manually, others bring to light actions that often remain unnoticed in groupware environments, such as group members logging in and viewing the work of others in a timely manner. Such information can be highly useful in an online collaborative environment, and making it readily apparent is a core objective of awareness mechanisms (Borges & Pino, 1999; Borges et al., 2000; Jang et al., 2000). Due to its unabstracted statistical nature, this presentation style did not make use of the points and limits detailed above.

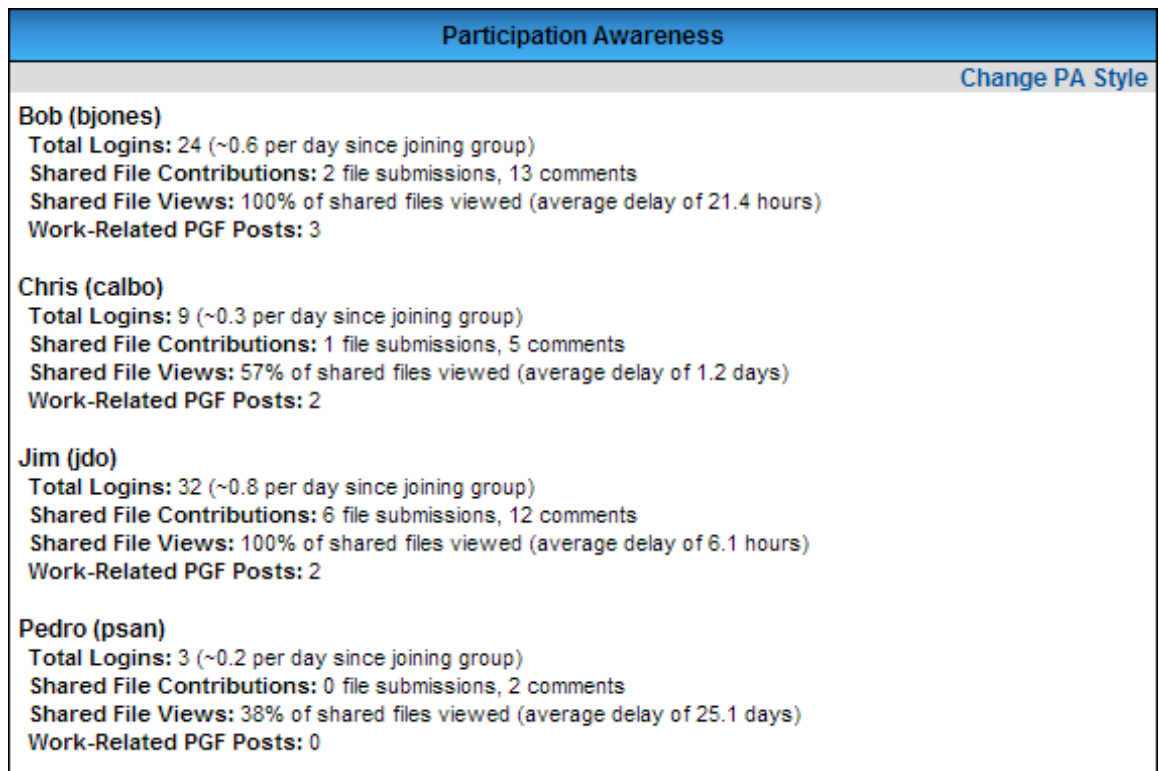


Figure 3.17 – The Simple Text presentation style

The ‘Simple Graphics’ style displays participation awareness as three pie charts, showing file activity, forum activity and general activity (Figure 3.18). Pie charts were utilised as they are familiar and easy to interpret, making them desirable when trying to convey information at-a-glance. A pie chart was used to convey aggregated awareness information in Zumbach et al. (2004). Although the use of pie charts to represent groups of distinct actions in GroupShare keeps this style somewhat unabstracted, it does apply points and limits to the metrics, in order to reflect the relative value of actions and deter noise and gaming.

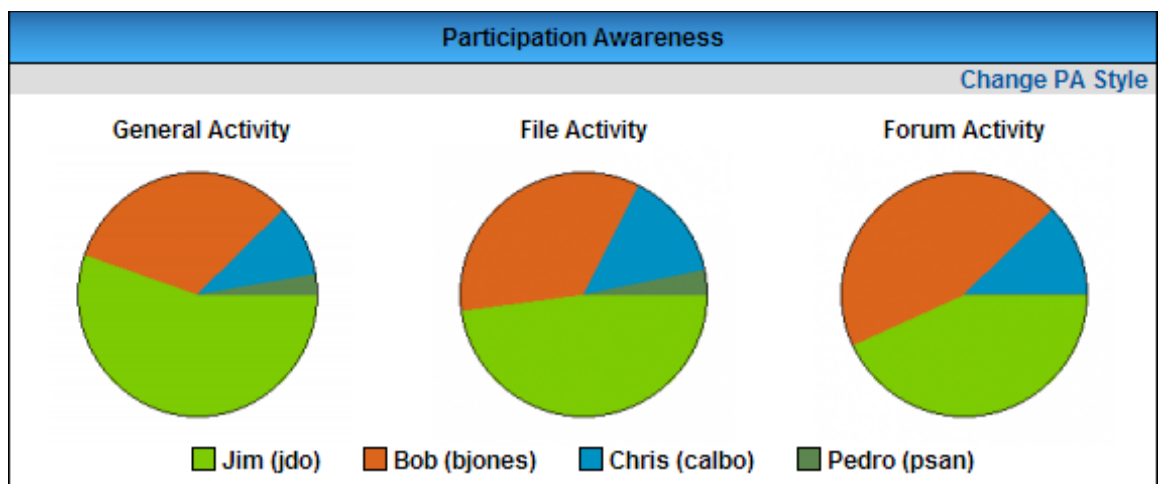


Figure 3.18 – The Simple Graphics presentation style

The 'Complex Text' style displays participation awareness in a table, showing a measure of Contribution, Communication and Activity for each member, which is then totalled to provide an Overall measure (Figure 3.19). The measures are ordinal, displaying both a progressive total over the length of the group's existence and a daily total, which is then compared to yesterday's total. Complex Text abstracts the metrics, taking into account the points and limits to provide measures of Contribution, Communication and Activity. While this style is not as open to at-a-glance interpretation, it provides distinct measurements and introduces the element of time via the display of daily totals. The totals displayed in the Complex Text style are used in later chapters of this thesis where comparisons of participants or usage against the participation awareness mechanism are required. This style was chosen as it produces ordinal values, which take all elements of the participation awareness mechanism into account – the full range of captured actions, the assignment of Contribution, Communication and Activity points, and the application of limits.

Participation Awareness				
Member	Contribution	Communication	Activity	Change PA Style
				Overall
Bob (bjones)	Total: 135 Today: 35 (▲ 17%)	Total: 175 Today: 37 (▲ 28%)	Total: 357 Today: 55 (▼ 8%)	Total: 667 Today: 127 (▲ 7%)
Chris (calbo)	Total: 39 Today: 0 (▼ ∞)	Total: 63 Today: 11 (▼ 62%)	Total: 122 Today: 14 (▼ 72%)	Total: 224 Today: 25 (▼ 73%)
Jim (jdo)	Total: 176 Today: 31 (▲ 7%)	Total: 240 Today: 39 (▲ 5%)	Total: 492 Today: 51 (▼ 20%)	Total: 908 Today: 121 (▼ 7%)
Pedro (psan)	Total: 16 Today: 8 (● 0%)	Total: 23 Today: 14 (▲ 133%)	Total: 48 Today: 18 (▲ 13%)	Total: 87 Today: 40 (▲ 33%)

Figure 3.19 – The Complex Text presentation style

The final presentation style is named 'Complex Graphics'. This style uses the same abstracted categories of Contribution, Communication and Activity as Complex Text, but displays the data as a series of line graphs, each displaying one category over time (Figure 3.20). For the first two weeks of a group's existence, the X axis displays in days. After this, it is displayed in weeks. The element of time is a major factor of the Complex Graphics style, allowing users to view the participation of group members throughout the length of the group's existence.

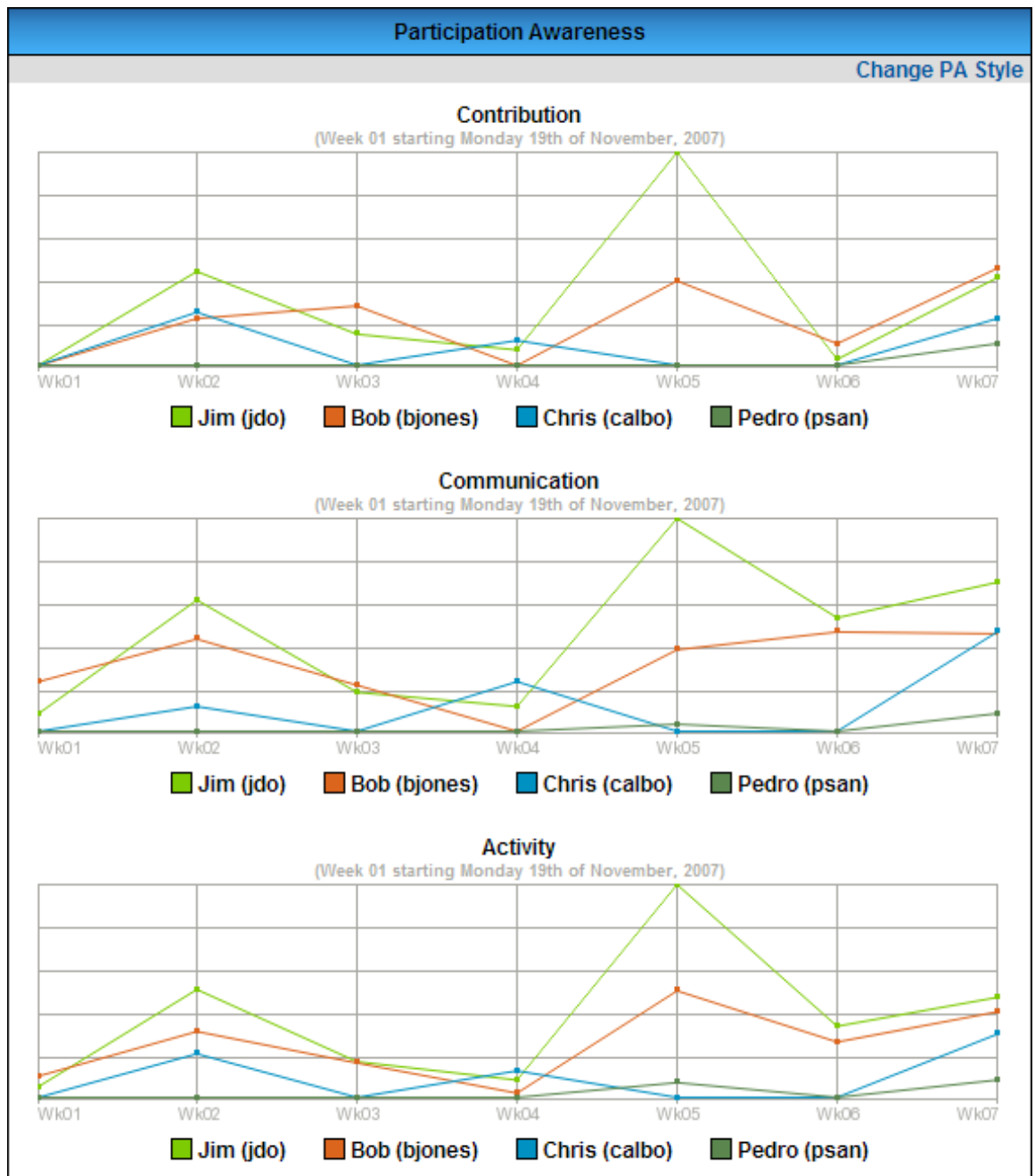


Figure 3.20 – The Complex Graphics presentation style

The participation awareness mechanism in GroupShare is the first fully-fledged implementation of participation awareness. As such, the methods and processes used to define, weigh and process metrics and present the resultant awareness information have been designed based on the literature and the author’s own knowledge and experience. By evaluating the participant response to the mechanism, the methods and processes implemented in GroupShare can be refined in order to develop a generically applicable model of participation awareness.

## **Chapter 4 – Questionnaire Responses and Demographics**

Responses to the pre and post-usage questionnaires were the primary source of data in the research, with the staff questionnaire serving as one of several supplementary sources. Details of the administration and content of the questionnaires have been provided in Chapter 3 and Appendices H to J. This chapter provides an overview of the questionnaire responses and participant demographics, presenting the numerical data which is further analysed and discussed in the following chapters. Responses to open-ended questions in the questionnaires are summarised in this chapter, with a sample of them being reproduced in following chapters where appropriate. For the sake of clarity, the reproduction of questionnaire items in this chapter omits any instructions or examples that were present in the questionnaires, unless deemed helpful in understanding the responses. The full instructions and examples available to participants can be found in Appendices H to J.

References to ‘positive’ or ‘negative’ responses to Likert-type questions in this and following chapters refer to the combined percentage of agree and strongly agree responses, and the combined percentage of disagree and strongly disagree responses respectively. For example, a question receiving 25 strongly agree and 35 agree responses out of a total of 100 responses would have a positive response of 60%. A ‘neutral’ response simply refers to the percentage of neutral responses. Where appropriate, the two largest response groups are cited, in order to further clarify or contextualise a response. To illustrate this with an example – a positive response of ‘55%’ does not appear overly positive, however when cited as ‘55% (35% neutral)’ one can deduce that the positive response is indeed considerably greater than the negative response. All percentages have been rounded to the nearest whole number. Where multiple responses have been combined into a single percentage, such as the positive and negative responses to Likert-type questions described above, percentages have been calculated and rounded after addition, to minimise rounding inaccuracies.

Across both iterations of the research, 63 student participants provided complete data sets, consisting of a pre-usage questionnaire response, GroupShare usage data generated via using the application, and a post-usage questionnaire response. Unless

otherwise stated, the term ‘participants’ in this and following chapters refers to these 63 participants. Incomplete data sets were received from a further 82 students, 80% of which consisted of a pre-usage questionnaire only. Details of response rates can be found in Sections 4.2 and 4.4. Incomplete data sets were not utilised in analysis pertaining to participants, however all available data from students who did not provide complete data sets was utilised in group and unit-based analysis.

#### **4.1 Participant Demographics**

A small amount of demographic data was collected via consent forms (Appendix E) which were administered at the beginning of the usage period, before the pre-usage questionnaire. Most, 76%, participants were under 31 years of age (Table 4.1), and 63% were male (Table 4.2). Young men were the most prominent age/gender combination in the participant sample, with 37 (59%) participants being males under 31 years of age.

*Table 4.1 – Demographic data, age (N=63)*

<b>Age.</b>				
Under 21	21-30	31-40	41-50	Over 50
25	23	5	3	7

*Table 4.2 – Demographic data, gender (N=63)*

<b>Gender.</b>	
Male	Female
40	23

Only 16% of participants were enrolled to study their participating unit online (Table 4.3), however it must be remembered that the large majority of students in participating units studied on campus, and hence the proportion of online participants is as high as could realistically be expected. The consent form reproduced in Appendix E does not include mention of study mode, as online students were contacted via e-mail.

*Table 4.3 – Demographic data, study mode (N=63)*

<b>Study mode (of participating unit).</b>	
On Campus	Online
53	10



The large majority of participants were Australian, with only 11% being of foreign nationalities (Table 4.4). All seven of the foreign students had a different nationality, with the most common continent of origin being Asia.

Table 4.4 – Demographic data, nationality (N=63)

Nationality.	
Australian	Other
56	7

To offer additional context to any reference of an individual participant, Appendix M contains the full demographic data of all 63 participants. The table contains the age range, gender, study mode, nationality and participating unit of each participant. Participant profiles in Chapter 5 examine questionnaire summary value responses from a number of participant-level perspectives, including those based on the demographic data. The author feels that the demographic diversity of the participants was appropriate and adequately representative of the research context. However, a higher number of participants studying online, exhibiting a wider range of ages and genders, could have improved this further.

## 4.2 Pre-Usage Questionnaire

Administered before or at the beginning of the usage period, the pre-usage questionnaire concerned background information and attitudes, such as Internet usage and thoughts regarding group work. Over both iterations of the research, a total of 129 pre-usage questionnaire responses were received. However, only 63 (49%) of the participants who gave these responses then went on to provide a complete data set (Table 4.5).

Table 4.5 – Pre-usage questionnaire responses

Research Iteration	Total Responses	Complete Data Sets
Pilot	60	26 (43%)
Main	69	37 (54%)
<b>Total</b>	<b>129</b>	<b>63 (49%)</b>

While this full-response rate may seem low, it was expected by the author due to the nature of the research. Many students who were open to the idea of using

GroupShare and participating in the research (and hence completed the pre-usage questionnaire) did not end up finding a need to use GroupShare to support their group work. Usage data indicates that some students used GroupShare for a short period, but their group as a whole failed to reach critical mass and usage was soon discontinued. Most of the attrition can be attributed to those who did not end up using GroupShare, rather than those who used the application throughout the usage period but did not complete the questionnaires – as evidenced by the considerably higher full-response rate of post-usage questionnaires (Section 4.4).

### 4.2.1 Section 1 - Internet Usage and Experience

The responses to this section revealed the large majority of participants to be frequent Internet users, with 73% of participants using it more than once a day (Table 4.6) and 83% using it for between two and 10 hours per day (Table 4.7).

Table 4.6 – Pre-usage questionnaire, question 1 (N=63)

<b>Q1. Approximately how often do you typically use the Internet, including e-mail, during a week?</b>			
Less than twice a week	Several times a week	Once a day	More than once a day
0	9	8	46

Table 4.7 – Pre-usage questionnaire, question 2 (N=63)

<b>Q2. Approximately how long do you typically spend using the Internet, including e-mail, during a day?</b>			
Less than 2 hours	2 to 5 hours	6 to 10 hours	More than 10 hours
7	37	15	4

The next question asked participants to select the locations from which they regularly accessed the internet. Responses revealed the Internet was primarily accessed from home (97%) and university (65%). Both responses in the ‘other’ category cited a friend’s home as a point of Internet access (Table 4.8).

Table 4.8 – Pre-usage questionnaire, question 3 (N=63, multiple selections permitted)

<b>Q3. From where do you regularly access the Internet? (Check all that apply)</b>				
Home	Work	University	Public Access	Other
61	23	41	3	2

Participants used the Internet for all common activities, with study and socialising being the most common at 95% and 86% respectively. The majority of responses in

the 'other' category could be assigned into the 'study' or 'socialising' responses, however commerce and browsing for information were identified as other activities (Table 4.9).

Table 4.9 – Pre-usage questionnaire, question 4 (N=63, multiple selections permitted)

<b>Q4. What activities to you typically use the Internet for? (Check all that apply)</b>				
Socialising	Study	Entertainment	Downloading	Other
54	60	40	43	7

Table 4.10 – Pre-usage questionnaire, question 5 (N=63)

<b>Q5. What speed Internet connection do you most often use?</b>	
Low Speed (dialup)	High Speed (broadband, cable, etc)
1	62

All but one (98%) participant had access to high speed Internet for the majority of their Internet usage (Table 4.10). A total of 79% of participants considered themselves to be experienced Internet users (Table 4.11), with 90% stating that they often used resources on the Internet to support their studies (Table 4.12).

Table 4.11 – Pre-usage questionnaire, question 6 (N=63)

<b>Q6. I consider myself to be an experienced Internet user.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	1	11	26	24

Table 4.12 – Pre-usage questionnaire, question 7 (N=63)

<b>Q7. I often use resources on the Internet to support my studies.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	1	5	31	26

Overall, the responses to this section indicate that the majority of participants were regular Internet users who were accustomed to using it to support their studies. In order to gain a deeper understanding of participants' Internet usage, the author aggregated questions in this section to produce a 'summary value' of Internet usage, detailed in Table 4.13.

Table 4.13 – Summary value 1 (N=63)

High:	Q1 >= once a day, Q2 >= 2-5 hours, Q4 >= 3 different activities		
Moderate:	Q1 >= several times a week, Q2 >= 2-5 hours, Q4 >= 3 different activities		
Low:	Internet used less than the amount required for Moderate		
<b>SV1. Internet Usage</b>			
	Low	Moderate	High
	8	16	39

The summary value labelled 62% of participants as having ‘high’ Internet usage and a further 25% were labelled as ‘moderate’ users. The summary value shows that the overall level of Internet usage amongst participants was indeed high, but not quite as high as the responses to the first two questions of the questionnaire could be assumed to suggest when considered individually. Cross-examining the summary value with participant age ranges revealed a larger proportion of ‘high’ Internet users amongst the participants of up to 30 years of age, with participants 31 and older having larger proportions of ‘moderate’ and ‘low’ Internet usage. High Internet usage was marginally more prominent amongst male participants.

#### 4.2.2 Section 2 - University Enrolment Details

While the first question in this section (Table 4.14) was open-ended, it was a short-answer factual question regarding participants’ course of study. Responses were coded and grouped into three primary categories and an ‘other’ category. The majority (78%) of participants were studying a form of Computer Science (54%) or Information Technology (24%). Library Technology courses accounted for a further eight participants, while the rest were enrolled in other courses such as Record Management or Digital Media.

Table 4.14 – Pre-usage questionnaire, question 8 (N=63)

<b>Q8. What course or degree are you currently enrolled in at [the university]?</b>			
Computer Science	Information Technology	Library Technology	Other
34	15	8	6

Only 21% of participants were studying at a postgraduate level (Table 4.15), most of whom were studying Information Technology. The same number (13, 21%) of participants were studying part-time (Table 4.16), and 77% of these participants were postgraduate students.

Table 4.15 – Pre-usage questionnaire, question 9 (N=63)

Q9. What is your current level of study?	
Undergraduate	Postgraduate
50	13

Table 4.16 – Pre-usage questionnaire, question 10 (N=63)

Q10. Are you currently a full-time or part-time student?	
Full-time	Part-time
50	13

Responses to questions 11 and 12 (Table 4.17 and Table 4.18) revealed a preference for on campus study, with 67% being enrolled as such, and 75% choosing it as their preferred mode of enrolment.

Table 4.17 –Pre-usage questionnaire, question 11 (N=63)

Q11. What is your current mode of study?		
On Campus	Online / External	Mixed
42	10	11

Table 4.18 –Pre-usage questionnaire, question 12 (N=63)

Q12. Which mode of study do you typically prefer?		
On Campus	Online / External	Mixed
47	7	9

### 4.2.3 Section 3 - Group Work

Section 3 concerned participants’ thoughts and experiences of group work in university study. The majority, 63%, of participants indicated that they had been required to participate in group work one to three times in their studies, with a further 25% having had four to six group work experiences (Table 4.19).

Table 4.19 – Pre-usage questionnaire, question 13 (N=63)

Q13. Approximately how many times have you been required to work in a group as part of your university studies?				
Never	1 to 3 times	4 to 6 times	7 to 9 times	More than 10 times
4	40	16	2	1

Table 4.20 – Pre-usage questionnaire, question 14 (N=63)

Q14. Approximately how much of this group work was conducted primarily online?				
None	Some	Half	Most	All
14	25	8	7	9

Online group work was not new to most participants, with 78% reporting that at least some of their university-based group work had been conducted primarily online. A high degree of online group work was not overly evident though, as 40% of participants indicated that less than half ('some') of their prior group work had been conducted online, and 22% stated that none of it had (Table 4.20). Participants recognised the use of online methods to support group work, with 51% (29% neutral) agreeing that a large amount of communication and collaboration takes place online, regardless of their mode of study (Table 4.21).

Table 4.21 – Pre-usage questionnaire, question 15 (N=63)

<b>Q15. When completing group work I find that a large amount of the communication and collaboration takes place online, regardless of my mode of study.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5	8	18	28	4

Table 4.22 – Pre-usage questionnaire, question 16 (N=63)

<b>Q16. When working in groups, I prefer to be the group leader.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3	16	34	8	2

Participants were largely neutral (54%) when it came to being the leader of their group, however more participants, 30%, preferred not to lead (Table 4.22). The following two questions (Table 4.23 and 4.24) revealed a dislike of group work amongst the majority of participants, with 51% (32% neutral) feeling that they learn less in assignments requiring group work compared to those requiring individual work, and 59% (21% neutral) finding group assignments less appealing than individual ones.

Table 4.23 – Pre-usage questionnaire, question 17 (N=63)

<b>Q17. I feel that I learn more in assignments requiring group work compared to those requiring individual work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
7	25	20	10	1

Table 4.24 – Pre-usage questionnaire, question 18 (N=63)

<b>Q18. Assignments requiring group work are less appealing than those requiring individual work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	13	13	24	13

This may be further explained by the response to question 19 (Table 4.25), in which 71% (19% neutral) of participants stated that they felt group assignments were more

challenging than individual ones. Only six of the 45 participants who found group-based assignments more challenging found them to be more appealing than individual assignments.

Table 4.25 – Pre-usage questionnaire, question 19 (N=63)

<b>Q19. I feel that assignments requiring group work are more challenging than those requiring individual work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	6	12	34	11

An up-to-date understanding of group members’ work-related activities was deemed important by 89% of participants (Table 4.26). Equal participation by all group members was also deemed important, receiving a 97% positive response (Table 4.27). Despite this, 60% (22% neutral) of participants had experienced unequal participation amongst group members in previous group assignments (Table 4.28). Of the 61 participants who felt that equal participation was important, 37 (59%) had experienced unequal participation in the past.

Table 4.26 – Pre-usage questionnaire, question 20 (N=63)

<b>Q20. An up-to-date understanding of group members' work-related activities is important in group assignment work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	2	5	43	13

Table 4.27 – Pre-usage questionnaire, question 21 (N=63)

<b>Q21. Equal participation by group members is important in group assignment work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	1	1	24	37

Table 4.28 – Pre-usage questionnaire, question 22 (N=63)

<b>Q22. In my previous group assignment work, participation was equal amongst all group members.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
16	22	14	8	3

Although prior questions revealed that many participants were apprehensive towards group assignment work, 62% (27% neutral) felt they worked well in a group (Table 4.29). Of the 13 participants who found assignments requiring group work to be more appealing, 11 felt that they worked well in a group.

Table 4.29 – Pre-usage questionnaire, question 23 (N=63)

<b>Q23. I feel that I work well in a group.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2	5	17	32	7

A total of 79% of participants felt that they understood the potential benefits of including group work in their university studies, however only 33% (43% neutral) felt that those benefits were usually fully achieved (Table 4.30 and Table 4.31). Interestingly, of the 13 participants who found group assignments more appealing, four of them responded positively to question 25, four responded negatively, and five responded neutrally. The large neutral response to this may include participants who felt that the benefits of group work were only partially or occasionally realised – the author acknowledges that the wording of the question could have been improved.

Table 4.30 – Pre-usage questionnaire, question 24 (N=63)

<b>Q24. I feel that I understand the potential benefits of including group assignment work in university studies.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	2	11	42	8

Table 4.31 – Pre-usage questionnaire, question 25 (N=63)

<b>Q25. In my experience, I feel that these benefits are usually fully achieved.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4	11	27	21	0

E-mail, face-to-face discussion and online instant messaging were identified as the three primary methods used by participants to communicate with their group members, being used by 79%, 71% and 54% of participants respectively (Table 4.32). Telephone-based text messaging was identified as a communication method in the ‘other’ responses.

Table 4.32 – Pre-usage questionnaire, question 26 (N=63, multiple selections permitted)

<b>Q26. What are your primary means of contacting group members when completing group-based unit work? (Check all that apply)</b>						
E-mail	In Person	Instant Messaging	Blackboard	Telephone	Online Forum / Web site	Other
50	45	34	15	25	13	5

The section concluded with a pair of open-ended questions asking participants what they liked the most and the least about group work. Numerous issues were identified,



summarised in Table 4.33 and Table 4.34. The most commonly cited reasons for liking group work were the collaborative aspects – sharing a workload, and being able to develop solutions amongst group members with various areas of expertise and points of view. The reasons for disliking group work help to explain the apprehension towards group assignments discernable in questions 17 and 18, and emphasised the importance of equal participation covered in questions 21 and 22. The primary reasons for disliking group work were unequal or poor participation by group members, the need to rely on others, and logistical issues such as finding a time and place to meet which suits all group members. The reasons for disliking group work expressed by participants of this research reflect those observed in the literature, such as Wulf (2005, p. 247):

The biggest problem is the Loafing Larry, Loafing Lucy syndrome in which group members fail to contribute significantly to the group effort. .... In addition to previous negative experiences with group work, students often have rather full schedules and are not readily available to meet with each other outside of class and resent external group assignments that may require them to do so.

Participants with experience studying online, and often at long distance, expressed greater difficulty in communicating and collaborating effectively with their group members.

Table 4.33 – Pre-usage questionnaire, question 27 (N=63, open-ended question)

<b>Q27. What do you like the <i>most</i> about group work? (Open-ended question)</b>
Sharing a workload and collaborating to complete work, having a wider range of expertise and points of view, developing communication and interpersonal skills, feeling part of a team and remaining motivated, meeting and getting to know other students, reducing the isolation of online learning.

Table 4.34 – Pre-usage questionnaire, question 28 (N=63, open-ended question)

<b>Q28. What do you like the <i>least</i> about group work? (Open-ended question)</b>
Unequal or poor quality participation, having to rely on others, problems and delays in communicating with group members, time and location issues making it difficult to collaborate effectively, dominant or rude group members, lack of group member activity awareness, lack of prior experience in group work.

Two summary values were constructed from the responses in this section, aiming to deduce participants' overall affinity to group work (Table 4.35), and their overall experience with online group work (Table 4.36).

Table 4.35 – Summary value 2 (N=63)

Likert-type responses assigned values of -2 (SD), -1 (D), 0 (N), 1 (A) and 2 (SA). Responses to questions 17, 18, 22, 23, and 25 totalled (polarity switched for question 18 due to negative wording) to give a sum value between 10 and -10.				
Strongly Positive: Sum value of 10, 9, 8, 7 or 6				
Mildly Positive: Sum value of 5, 4, 3 or 2				
Neutral: Sum value of 1, 0 or -1				
Mildly Negative: Sum value of -2, -3, -4 or -5				
Strongly Negative: Sum value of -6, -7, -8, -9 or -10				
<b>SV2. Group Work Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
4	27	18	12	2

Table 4.36 – Summary value 3 (N=63)

High:	Q13 >= 4 to 6 times, Q14 >= Half, Q26 >= 2 online communication methods		
Moderate:	Q13 >= 1 to 3 times, Q14 >= Some, Q26 >= 1 online communication method		
Low:	Group work experiences and communication methods less than the amount needed for Moderate (Online communication methods defined as E-mail, Instant Messaging, Blackboard, or Online Forum / Web site)		
<b>SV3. Online Group Work Experience</b>			
Low	Moderate	High	
14	42	7	

Responses to individual questions throughout this section of the pre-usage questionnaire gave the impression that the majority of participants disliked group-based assignment work, and that most of the participants had some experience in online group work. The summary values confirm and refine this impression, with 49% of participants having a negative affinity to group work, compared to the 22% who had a positive affinity to it. It is worth noting that the largest proportion (43%) of participants fell into the ‘mildly negative’ category, indicating that while general dislike of group work was evident, participants were not strongly polarised against it. No strong correlations were found between participant age and group work affinity, although males were found to have a slightly better affinity towards group work than females. Summary value 3 places 67% of participants into the ‘moderate’ category for online group work experience, with most other (22%) participants having a ‘low’ level of such experience. No relationship was found between the preferred or enrolled study mode of participants and online group work experience, suggesting that all modes of study experience comparable amounts of online group work. No noteworthy correlations were found between the two summary values.

#### 4.2.4 Section 4 - Group Support Software (Groupware)

This section queried participants' thoughts and experiences regarding groupware, defined in the questionnaire as "software and online systems used to support group work". As Table 4.37 illustrates, 97% of participants had used an OLE in their university studies. A much lower amount, 16%, had used a groupware application to support group work unrelated to their university studies (Table 4.38).

Table 4.37 – Pre-usage questionnaire, question 29 (N=63)

<b>Q29. Have you used an online learning environment such as BlackBoard or eCourse in your university studies?</b>	
No	Yes
2	61

Table 4.38 – Pre-usage questionnaire, question 30 (N=63)

<b>Q30. Have you used groupware to support group work unrelated to your university studies?</b>	
No	Yes
53	10

Participants identified online applications such as Yahoo! Groups and Google Groups as the most commonly used groupware application, with very few participants having previously used groupware which requires software to be installed locally (Table 4.39). At only 8% of participants, even the online groupware applications were not commonly used.

Table 4.39 – Pre-usage questionnaire, question 31 (N=63, multiple selections permitted)

<b>Q31. Which of the following groupware systems have you used to support any kind of group work? (Check all that apply)</b>				
Lotus Notes	Microsoft SharePoint or Exchange	Basic Support for Collaborative Work (BSCW)	Yahoo! Groups, Google Groups or similar	Other
2	2	0	5	7

Responses in the 'other' category identified a couple of lesser-known groupware applications, but the majority cited Web-based systems such as discussion forums, wikis, and Blackboard. GroupShare was named by two participants from the main iteration of the research who had used it in the pilot. Grouping all responses into either Web-based or locally installed groupware emphasises the preference for the online form of groupware, with 19% of participants having used it, compared to 10% having used locally installed groupware (Table 4.40).

Table 4.40 – Categorisation of groupware types identified in pre-usage questionnaire, question 31

Categorisation of groupware types identified in pre-usage questionnaire, question 31.	
Locally Installed	Web-based
6	12
Lotus Notes (2), Microsoft SharePoint or Exchange (2), Microsoft Groove (1), Subversion (1)	Yahoo! Groups, Google Groups or similar (5), Wikis (2), GroupShare (2), Discussion Forums (2), Blackboard (1)

Question 31a, an open-ended question, asked participants to summarise what the groupware applications were used for (Table 4.41). The responses listed common activities such as file and information sharing, communication and coordination.

Table 4.41 – Pre-usage questionnaire, question 31a (N=14, optional open-ended question)

Q31a. If applicable, please summarise what the system(s) were used for. (Open-ended question)
Collaboration, file sharing and version management, real-time and asynchronous communication, coordination, peer review, sharing a knowledgebase, keeping all group members up-to-date.

Despite the relatively low number of participants who had used groupware to support their group work in the past, 71% (25% neutral) felt that using groupware to support group work was beneficial, even when some face-to-face contact was possible (Table 4.42). Furthermore, 59% (40% neutral) felt that using a dedicated groupware application was more beneficial than using a general communications tool such as e-mail to support group work (Table 4.43).

Table 4.42 – Pre-usage questionnaire, question 32 (N=63)

Q32. I feel that using groupware to support group work is beneficial, even when some face-to-face contact is possible.				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	1	16	36	9

Table 4.43 – Pre-usage questionnaire, question 33 (N=63)

Q33. I feel that using a dedicated groupware system (such as those listed in question 31) to support group work is more beneficial than using a general communication tool (e.g. e-mail, forum or instant messaging).				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	1	25	25	12

#### 4.2.5 Section 5 - Participation in Group Work

The penultimate section of the pre-usage questionnaire concerned participation in group work. Responses to question 34 suggested that participants recognised the value of indirect participation, with 84% stating that they felt participation in group work involved more than the direct contribution of work (Table 4.44).

Table 4.44 – Pre-usage questionnaire, question 34 (N=63)

<b>Q34. I believe that <i>participation</i> in group work involves more than the direct contribution of work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	3	7	43	10

The following question asked participants to indicate how important they felt four different aspects of participation in group work were, using a modified Likert scale (Table 4.45). Contributing work, communicating with group members and remaining up-to-date with the project status were all seen to be important, receiving 97%, 97%, 98% positive responses, respectively. Providing feedback on the work of others was deemed the least important, but still received an 83% positive response. A single participant rated all four aspects as ‘Very Unimportant’. Nothing in the participant’s data set explains or justifies such a response, and hence the author suspects that the participant may have misread the question or response categories.

Table 4.45 – Pre-usage questionnaire, question 35 (N=63)

<b>Q35. Please indicate how important you feel the following things are when participating in group work.</b>					
	Very Unimportant	Unimportant	Neutral	Important	Very Important
<b>35a.</b> Contributing work.	1	0	1	26	35
<b>35b.</b> Communicating with other group members.	1	0	1	19	42
<b>35c.</b> Remaining up-to-date with the overall status of the project and the work of other group members.	1	0	0	25	37
<b>35d.</b> Providing feedback on the work of other group members.	1	2	8	34	18

Questions 36 and 37 (Table 4.46 and Table 4.47) used a ranking format, asking participants to rank four aspects of direct and four aspects of indirect participation from one to four, with one being the most important. The author recognised that some participants might have trouble completing these questions, due both to the involved nature of the question format and the content of the question – all of the aspects being desirable. Hence, to avoid frustration and non-completion, the real-time validation of these questions only confirmed that each aspect had received an acceptable rank, without checking if ranks had been repeated. Responses that did not complete these questions in a valid manner were omitted in the analysis and the following tables, resulting in a total of 59 and 60 responses to questions 36 and 37 respectively. Their omission had no discernable impact on the overall results of the questions.

Table 4.46 – Pre-usage questionnaire, question 36 (N=59)

<b>Q36. Direct participation refers to ways in which group members can directly contribute to the completion of group work. Please rank the following aspects of direct participation in order of importance, with 1 being the most important.</b>				
	4 (Least Important)	3	2	1 (Most Important)
Contributions are of high quality.	5	19	17	18
Contributions are of appropriate length.	39	15	5	0
Contributions are timely.	10	9	23	17
All assigned work is completed.	2	16	14	24

Table 4.47 – Pre-usage questionnaire, question 37 (N=60)

<b>Q37. Indirect participation refers to indirect ways in which group members can assist in the completion of group work. Please rank the following aspects of indirect participation in order of importance, with 1 being the most important.</b>				
	4 (Least Important)	3	2	1 (Most Important)
Group member demonstrates up-to-date knowledge regarding the overall status of the project.	15	20	13	12
Group member shares thoughts, opinions and feedback on work contributed by other group members.	4	14	25	17
Group member communicates with the rest of the group in a social manner.	25	11	9	15
Group member reads/views all work contributed by other group members.	16	15	13	16

Optional open-ended areas were available should participants wish to elaborate on their rankings. Responses to these fell into two categories – individual justifications or explanations of a participant’s ratings, or comments stating that all aspects were important and hence hard to rate. No strong recurring themes emerged amongst the justifications or explanations. A selection of the responses have been reproduced below, to illustrate their typical content. Original spelling and grammar have been preserved.

Time is the most important factor. The length doesnt matter, as long as the qauality of the information be provided is important. (Participant 47)

Not easy to separate, all important. (Participant 50)

Most important is probably that people know whats going on.. if they don't know whats happening how can they contribute. (Participant 9)

To determine which aspects were deemed most important, the ratings in Table 4.46 and Table 4.47 were then assigned points and totalled. One point was awarded to a

rank of four, two points to a rank of three, three points to a rank of two, and four point to a rank of one. For example, the ‘Contributions are of high quality’ aspect in question 36 (Table 4.46) was ranked fourth 5 times, third 19 times, second 17 times and first 18 times. Hence, its total points are calculated via the formula ‘5x1 + 19x2 + 17x3 + 18x4’, resulting in 166 points. For further illustration, the average ranking of each aspect was also calculated, an average value close to one indicating higher importance. The average ranks, total points and overall ranks of the aspects in questions 36 and 37 are displayed in Table 4.48 and Table 4.49. In order to remain consistent with Tables 4.46 and 4.47, the original ordering of the response options has been preserved, rather than ordering them by rank.

Table 4.48 – Aspects of direct participation ranking totals (total sum of points = 590)

<b>Aspects of direct participation ranking totals.</b>			
	Average Rank	Total Points	Overall Rank
Contributions are of high quality.	2.19	166	2 <sup>nd</sup>
Contributions are of appropriate length.	3.58	84	4 <sup>th</sup>
Contributions are timely.	2.20	165	3 <sup>rd</sup>
All assigned work is completed.	2.03	175	1 <sup>st</sup>

Table 4.49 – Aspects of indirect participation ranking totals (total sum of points = 600)

<b>Aspects of indirect participation ranking totals.</b>			
	Average Rank	Total Points	Overall Rank
Group member demonstrates up-to-date knowledge regarding the overall status of the project.	2.63	142	3 <sup>rd</sup>
Group member shares thoughts, opinions and feedback on work contributed by other group members.	2.08	175	1 <sup>st</sup>
Group member communicates with the rest of the group in a social manner.	2.77	134	4 <sup>th</sup>
Group member reads/views all work contributed by other group members.	2.52	149	2 <sup>nd</sup>

The total points indicate that participants felt that the completion of all assigned work, the quality of contributions and their timeliness were the three most important aspects of direct participation, respectively, all scoring within 10 points (2%) of each other. The importance of contributions being of appropriate length was rated considerably lower, with a total of 84 points – approximately half as much as the other three aspects (Table 4.48). In the indirect aspects, the sharing of thoughts, opinions and feedback on the contributions of others ranked the highest by a margin of 4%. The remaining three aspects, which concerned demonstrating an up-to-date knowledge of the project status, communicating socially with the group and viewing/reading all work contributed by others, ranked within 2% of each other (Table 4.49).

Table 4.50 – Pre-usage questionnaire, question 38 (N=63, open-ended question)

<b>Q38. What do you feel are the most important aspects of participation (direct or indirect) in group work? (Open-ended question)</b>
Completion of work to a high standard, regular and effective communication with group members, timely completion of work and response to feedback, remaining up-to-date on the status of the project, adhering to schedules and timelines, willingness to work as part of a group and develop solutions as a team.

Table 4.51 – Pre-usage questionnaire, question 39 (N=40, optional open-ended question)

<b>Q39. What approaches (if any) have you used to judge the direct and indirect participation of your group members in your previous group work experience? (Open-ended question)</b>
Quality and effectiveness of communications with group members, completion of all assigned work, quality and timeliness of work, outcomes of group meetings, eagerness to participate, general observation of group member participation, peer review surveys, querying group members about their participation.

Question 38 (Table 4.50), an open-ended question, asked participants what they felt were the most important aspects of participation. The majority of responses could be categorised into the aspects listed in questions 36 and 37, with the most commonly cited ones relating to timely, high quality contribution and regular and effective communication with group members. The final question of the section (Table 4.51) was an optional open-ended question, asking participants what approaches they had used to judge the participation of group members in prior group work. Responses were varied, but tended to involve reflecting upon the quality and effectiveness of the aspects of participation that participants found to be important, such as contribution and communication. Impressions were also formed via group meetings and general observation of group members in face-to-face meetings – methods which, as discussed in Section 2.3, are greatly hampered when collaborating in an online environment.

#### 4.2.6 Section 6 - Measuring Participation in Online Groupware

In the final section, which concerned the measurement of participation in groupware, 44% (35% neutral) of participants expressed difficulty in knowing how much other group members are participating in online group work (Table 4.52), with 71% feeling it would be useful to have a better understanding of the participation of group members in such scenarios (Table 4.53).



Table 4.52 – Pre-usage questionnaire, question 40 (N=63)

<b>Q40. I sometimes find it difficult to know how much a group member is participating in online group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	12	22	22	6

Table 4.53 – Pre-usage questionnaire, question 41 (N=63)

<b>Q41. I feel it would be useful to have a better understanding of the participation of group members in online group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	6	12	31	14

A question asking participants if they felt it would useful to know more about the passive/unseen actions of group members in online group work also received a 71% positive response (Table 4.54). A total of 76% of participants felt that quality was more important than quantity for measuring participation in group work (Table 4.55).

Table 4.54 – Pre-usage questionnaire, question 42 (N=63)

<b>Q42. I feel it would be useful to know more about the passive/unseen actions (e.g. logging in, viewing work, reading messages) of group members in online group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	6	12	31	14

Table 4.55 – Pre-usage questionnaire, question 43 (N=63)

<b>Q43. In measuring an individual's participation in group work, I feel the <i>quality</i> of contributions is more important than the <i>number</i> of contributions.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2	2	11	34	14

The final two Likert-type questions (Tables 4.56 and 4.57) in the pre-usage questionnaire concerned rating the work of group members. When asked if they would rate work with complete honesty when doing so anonymously in a groupware environment, 90% of participants responded positively. When asked if they would rate work more honestly when face-to-face than in a groupware environment, regardless of anonymity, responses were quite dispersed, with only a third of participants stating that they would do so.

Table 4.56 – Pre-usage questionnaire, question 44 (N=63)

<b>Q44. I feel that I would rate group member contributions with complete honesty, when doing so <i>anonymously</i> in a groupware environment.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	1	4	36	21

Table 4.57 – Pre-usage questionnaire, question 45 (N=63)

<b>Q45. I feel that I would rate group member contributions more honestly when face-to-face than in a groupware environment, regardless of anonymity.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9	19	15	15	5

When asked what impact participants felt a display of group member participation would have on group work in an online environment (Table 4.58), most responses were positive – regularly citing effects such as encouraging greater participation, increased motivation, keeping group members on track, and improving group dynamics. Some participants also predicted that such a mechanism could potentially inspire competitiveness, increase pressure, and result in group members aiming for a high participation score rather than seeking to participate in a constructive manner.

Table 4.58 – Pre-usage questionnaire, question 46 (N=63, open-ended question)

<b>Q46. What impact do you feel a display of group member participation will have on group work in an online environment? (Open-ended question)</b>
Encourage participation and regular activity, keep group members on task and motivated, encourage ‘slackers’ to be more active, increase competitiveness and pressure, inform group members and settle participation disputes, improve group dynamics, highlight potential problems and inspire ‘number chasing’.

A summary value was defined based on responses to questions in this section, aiming to assess participants’ affinity to the concept of a participation awareness mechanism. By combining the responses to questions regarding a perceived lack of awareness and desire for better awareness in online group work scenarios, the summary value produced a 75% positive affinity to the concept of participation awareness (Table 4.59). While 11% of participants fell into the ‘mildly negative’ category, no participants were deemed ‘strongly negative’ towards the concept of participation awareness.

Table 4.59 – Summary value 4 (N=63)

Likert-type responses assigned values of -2 (SD), -1 (D), 0 (N), 1 (A) and 2 (SA). Responses to questions 40, 41 and 42 totalled to give a sum value between 6 and -6.				
Strongly Positive: Sum value of 6, 5 or 4				
Mildly Positive: Sum value of 3, 2 or 1				
Neutral: Sum value of 0				
Mildly Negative: Sum value of -1, -2 or -3				
Strongly Negative: Sum value of -4, -5 or -6				
<b>SV4. Participation Awareness Concept Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	7	9	32	15

A slightly higher proportion of females were classified as ‘neutral’ and ‘mildly negative’ towards the concept of participation awareness than men, although no correlations were found with the age of participants, their study mode, or their affinity towards group work.

### 4.3 Pre-Usage Questionnaire Summary

The pre-usage questionnaire gathered data pertaining to participants’ background and their thoughts and attitudes regarding group work. Four summary values were created (Table 4.60), covering the primary areas of interest explored in the pre-usage questionnaire.

Table 4.60 – Pre-usage questionnaire summary values (N=63)

<b>A. SV1. Internet Usage</b>				
Low		Moderate		High
8		16		39

<b>B. SV2. Group Work Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
4	27	18	12	2

<b>C. SV3. Online Group Work Experience</b>		
Low	Moderate	High
14	42	7

<b>D. SV4. Participation Awareness Concept Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	7	9	32	15

To assist in visualising these values, they have been presented graphically in Figure 4.1.

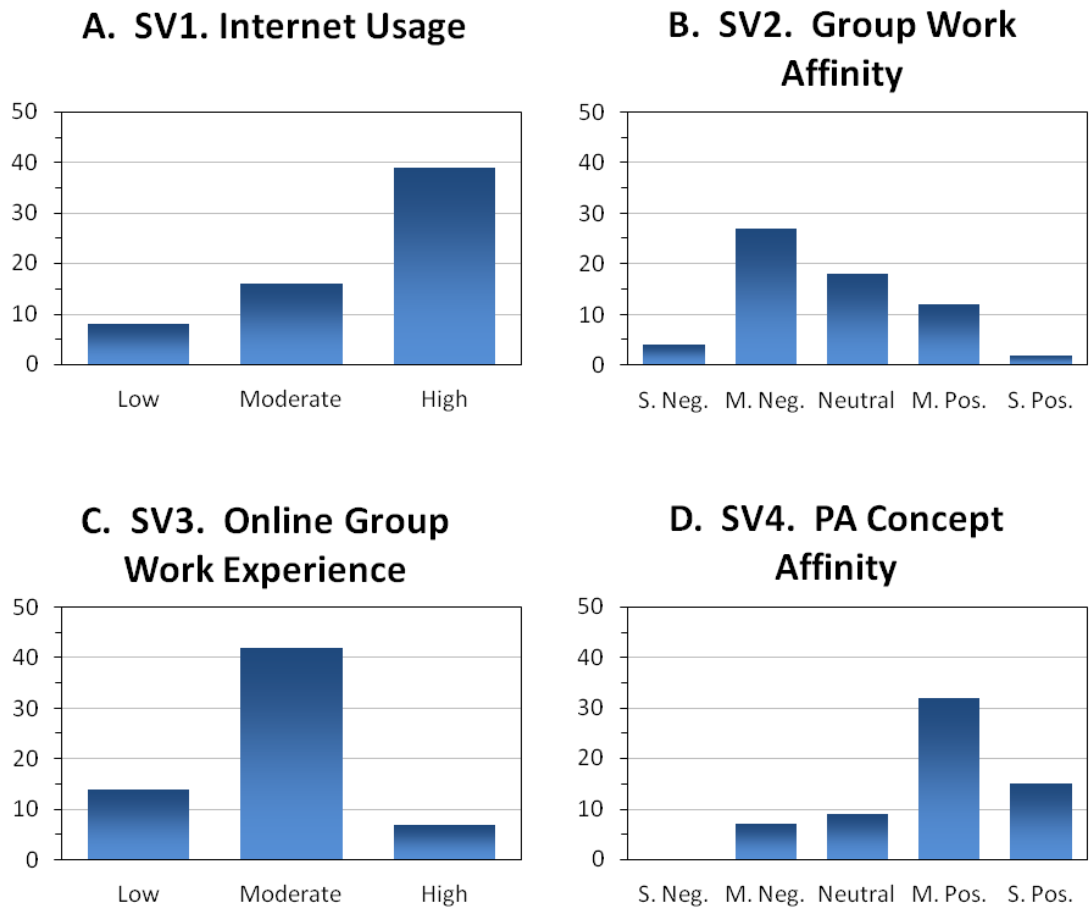


Figure 4.1 – Pre-usage questionnaire summary values (N=63)

#### 4.4 Post-Usage Questionnaire

The post-usage questionnaire was administered towards the end of each unit’s usage period, and remained available for some time after the conclusion of the usage period. The questionnaire sought feedback regarding GroupShare and the participation awareness mechanism. A total of 79 responses to the post-usage questionnaire were received over both iterations of the research. Of these, 63 (80%) were from participants who provided complete data sets (Table 4.61).

Table 4.61 – Post-usage questionnaire responses

Research Iteration	Total Responses	Complete Data Sets
Pilot	35	26 (74%)
Main	44	37 (84%)
<b>Total</b>	<b>79</b>	<b>63 (80%)</b>

As all students who completed the post-usage questionnaire had utilised GroupShare and therefore provided usage data, it is evident that 16 (20%) of these students did not complete the pre-usage questionnaire.

#### 4.4.1 Section 1 - General Group Work and GroupShare Usage

Responses to questions in the first section of the post-usage questionnaire reported consistent usage of GroupShare, with 92% of participants stating that they used it at least several times a week (Table 4.62). The average duration of a session using GroupShare was less than half an hour, with 62% typically using it for between 10 and 30 minutes, and a further 22% using it for less than 10 minutes (Table 4.63).

Table 4.62 – Post-usage questionnaire, question 1 (N=63)

<b>Q1. Approximately how often did you typically access GroupShare over the usage period?</b>			
Less than twice a week	Several times a week	Once a day	More than once a day
5	22	19	17

Table 4.63 – Post-usage questionnaire, question 2 (N=63)

<b>Q2. On average, how long did you use GroupShare for each time you logged in?</b>			
Less than 10 minutes	10 to 30 minutes	30 minutes to an hour	More than an hour
14	39	7	3

An optional open-ended area allowed participants to specify any periods of significantly greater or lesser GroupShare usage (Table 4.64). Responses to this indicated peak usage close to group assignment due dates and a rapid decline in usage after the completion of the group assignment, even if further group work was encouraged in the unit. Some participants reported low usage during the mid-semester break.

Table 4.64 – Post-usage questionnaire, question 3 (N=39, optional open-ended question)

<b>Q3. If you/your group used GroupShare significantly more or less during certain parts of the usage period, please specify. (Open-ended question)</b>
High usage close to assignment due dates, rapid decline in usage after completion of assignment, low usage during mid-semester break.

Question 4 and 5 revealed that most participants had regular contact outside of GroupShare, with 86% having face-to-face contact with their group members on a weekly or more frequent basis (Table 4.65). As all participating units were delivered in

a weekly manner, it is of no surprise that the majority of face-to-face contact occurred on a weekly basis. Most participants also reported contacting group members via other means such as phone or e-mail, 48% of which occurred on a weekly or more frequent basis (Table 4.66).

Table 4.65 – Post-usage questionnaire, question 4 (N=63)

<b>Q4. Approximately how often did you have face-to-face contact with your group members?</b>				
Never	Monthly	Every two weeks	Weekly	More than weekly
8	0	1	41	13

Table 4.66 – Post-usage questionnaire, question 5 (N=63)

<b>Q5. Approximately how often did you have contact with group members by other means (not face-to-face or using GroupShare)?</b>				
Never	Monthly	Every two weeks	Weekly	More than weekly
18	5	10	21	9

The section was closed with an optional open-ended area in which participants were able to provide any further comments regarding their group work and usage of GroupShare (Table 4.67). The majority of responses were general feedback regarding GroupShare and the participation awareness mechanism (addressed in the following sections). One participant described using GroupShare’s participation awareness to know when a group member had not been logging in to the application, which prompted him to contact the group member by e-mail.

Table 4.67 – Post-usage questionnaire, question 6 (N=12, optional open-ended question)

<b>Q6. If you have any further comments regarding your group work and usage of GroupShare that you feel are relevant, please write them below. (Open-ended question)</b>
General feedback regarding GroupShare and participation awareness mechanism, using the participation awareness mechanism to determine inactivity and prompt appropriate communication method, perceived inaccuracy and reported misuse (spam/noise/gaming) of the participation awareness mechanism.

#### 4.4.2 Section 2 - General GroupShare Feedback

GroupShare was received positively by the large majority of participants, with 89% stating that it made their group work easier to manage (Table 4.68), and 65% (29% neutral) stating that it made their group work more enjoyable (Table 4.69).

Table 4.68 – Post-usage questionnaire, question 7 (N=63)

<b>Q7. GroupShare made working in a group easier to manage.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	1	6	34	22

Table 4.69 – Post-usage questionnaire, question 8 (N=63)

<b>Q8. GroupShare made working in a group more enjoyable.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	4	18	28	13

GroupShare’s design and interface was found to be effective by 92% of participants (Table 4.70). The application was deemed well suited to support the tasks required in participants’ group work by 84% (Table 4.71). Such highly positive results are encouraging, affirming the generically applicable nature of GroupShare, which was not designed or tailored towards any particular type of group work or unit. An examination of the responses to question 10 against participating units did not reveal any higher or lower suitability of GroupShare towards a certain unit.

Table 4.70 – Post-usage questionnaire, question 9 (N=63)

<b>Q9. The design and interface of GroupShare allowed me to use the system effectively.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	1	4	33	25

Table 4.71 – Post-usage questionnaire, question 10 (N=63)

<b>Q10. GroupShare was well suited to support the tasks required in my group.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	2	8	38	15

The next question asked participants if they felt GroupShare was more useful for groups working primarily online, with little or no face-to-face contact (Table 4.72). This question received a 54% positive response, with 24% neutral. There were 10 participants who were enrolled as online students in their participating unit. Of these, five (50%) felt that GroupShare was best suited to primarily online groups, three (30%) were neutral on the topic, and two (20%) responded negatively.

Table 4.72 – Post-usage questionnaire, question 11 (N=63)

<b>Q11. I feel that GroupShare is more useful for groups working primarily online, with little or no face-to-face contact.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	14	15	18	16

A total of 73% (21% neutral) of participants felt that GroupShare made communicating with their group members easy (Table 4.73), and 78% (21% neutral) felt that GroupShare had an overall positive effect on their group's performance and outcomes (Table 4.74). The application left a good impression on participants, with 83% stating that they would like to use GroupShare again in future group work (Table 4.75).

Table 4.73 – Post-usage questionnaire, question 12 (N=63)

<b>Q12. GroupShare made communicating with my group members easy.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	4	13	31	15

Table 4.74 – Post-usage questionnaire, question 13 (N=63)

<b>Q13. I feel that GroupShare had an overall positive effect on my group's performance and outcomes.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	1	13	31	18

Table 4.75 – Post-usage questionnaire, question 14 (N=63)

<b>Q14. I would like to use GroupShare again in future group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	3	8	25	27

The final three questions of the section were open-ended, asking participants which aspects of GroupShare they liked the most and the least, and how they felt application could be improved. File sharing, the simple and effective interface, the participation awareness mechanism and the various communication tools were the most liked features (Table 4.76). The most disliked aspects of GroupShare were the lack of certain file related functionality such as version control and simultaneous editing, the lack of advanced features in the live chat, and the cluttered appearance of certain parts of the application – particularly when a large number of files had been shared (Table 4.77).

Table 4.76 – Post-usage questionnaire, question 15 (N=63, open-ended question)

<b>Q15. Which aspects of GroupShare did you like the most? (Open-ended question)</b>
File sharing, simple and efficient interface, communication tools, participation awareness, trophies, having an accessible and centralised workspace, awareness of group member activity, feedback via comments.

Table 4.77 – Post-usage questionnaire, question 16 (N=63, open-ended question)

<b>Q16. Which aspects of GroupShare did you like the least? (Open-ended question)</b>
Lack of version control for files, lack of simultaneous/shared editing of files, lack of folder structure for files, some areas appeared cluttered, live chat lacked advanced functionality, inaccurate participation awareness, awareness features caused feelings of guilt when participant could not log in for a while, minor bugs and occasional downtime.



Unsurprisingly, the majority of responses to question 17 suggested improvements which addressed the disliked aspects listed in question 16. These included better file management facilities, version control and enhancements to the live chat (Table 4.78). The participant response to GroupShare, examined in Section 7.1.1, was very positive overall and established the application as a suitably generic groupware environment from which to examine the participation awareness mechanism.

Table 4.78 – Post-usage questionnaire, question 17 (N=63, open-ended question)

<b>Q17. How do you feel GroupShare could be improved? (Open-ended question)</b>
Better file structure and management, version control for files, more robust live chat, e-mail or RSS activity notification, tweaking of participation awareness points and limits to improve accuracy, integration with other systems/applications, video conferencing.

### 4.4.3 Section 3 - Participation Awareness – General Feedback

While the participation awareness mechanism was well received overall, responses to this section were not as polarised towards the positive as those regarding GroupShare. Most participants, 56% (25% neutral), placed a significant amount of importance on the mechanism (Table 4.79).

Table 4.79 – Post-usage questionnaire, question 18 (N=63)

<b>Q18. I placed a significant amount of importance on the PA feature.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	11	16	26	9

In regards to accuracy, 65% of participants felt that the participation awareness mechanism accurately reflected their own participation in their group (Table 4.80), and 57% felt that it represented their group members accurately (Table 4.81). The questions received 22% and 24% negative responses respectively. Open-ended responses, examined in Table 4.91, indicate that the primary causes of perceived inaccuracy were group members manipulating the mechanism via spam and noise, too many points being awarded for ‘inane’ or ‘passive’ actions, and the lack of recognition for work done outside of GroupShare.

Table 4.80 – Post-usage questionnaire, question 19 (N=63)

<b>Q19. I feel that the PA feature accurately reflected my participation in the group.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2	12	8	34	7

Table 4.81 – Post-usage questionnaire, question 20 (N=63)

<b>Q20. I feel that the PA feature accurately reflected the participation of other group members.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2	13	12	30	6

The following questions regarded the impact and effect of the participation awareness mechanism, with 62% (24% neutral) of participants finding it encouraged them to be more active in their group (Table 4.82), and 43% (40% neutral) being encouraged to work harder (Table 4.83). A strong correlation was found between responses to question 18 and questions 21 and 22, with participants who placed little importance on the mechanism finding that it did not encourage them to be more active or work harder, and vice versa. The mechanism helped 57% (22% negative) of participants to understand their group members (Table 4.84).

Table 4.82 – Post-usage questionnaire, question 21 (N=63)

<b>Q21. I found that the PA feature encouraged me to be more active in the group.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	8	15	27	12

Table 4.83 – Post-usage questionnaire, question 22 (N=63)

<b>Q22. I found that the PA feature encouraged me to work harder.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2	9	25	18	9

Table 4.84 – Post-usage questionnaire, question 23 (N=63)

<b>Q23. I found that the PA feature helped me to understand my group members.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4	10	13	25	11

Only 17% of participants found the participation awareness mechanism made group work more stressful, with 56% feeling it did not (Table 4.85). The mechanism made group work more competitive for 41% (38% neutral) of participants (Table 4.86).

Table 4.85 – Post-usage questionnaire, question 24 (N=63)

<b>Q24. I found that the PA feature made group work more stressful.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4	31	17	9	2

Table 4.86 – Post-usage questionnaire, question 25 (N=63)

<b>Q25. I found that the PA feature made group work more competitive.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	12	24	17	9

The mechanism achieved its primary goal, with 73% (16% neutral) of participants stating that it made it easier to keep track of how much group members were participating (Table 4.87). Despite the highly positive response to question 26, only 44% (38% neutral) of participants felt that the participation awareness mechanism made group work more enjoyable (Table 4.88), and 56% (38% neutral) felt that it had an overall positive effect on their group (Table 4.89). Given the apprehension towards group work seen in the pre-usage questionnaire and the similarly lower response to question 8 which concerned GroupShare’s impact on group work enjoyment, the author feels that such questions could have been worded better. Enjoyment did not appear to be a sentiment commonly associated with group assignment work amongst participants.

Table 4.87 – Post-usage questionnaire, question 26 (N=63)

<b>Q26. The PA feature made it easier to keep track of how much group members were participating.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	6	10	31	15

Table 4.88 – Post-usage questionnaire, question 27 (N=63)

<b>Q27. Overall, I found the PA feature made group work more enjoyable.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3	8	24	20	8

Table 4.89 – Post-usage questionnaire, question 28 (N=63)

<b>Q28. Overall, I found the PA feature to have a positive effect on the group.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	3	24	27	8

The section concluded with open-ended areas allowing participants to comment on what they felt were the positive and negative impacts of the mechanism. The primary positive impacts identified echoed the prior questions – making participation easier to track, encouraging work and activity, and discouraging and identifying non-participation (Table 4.90). The negative impacts identified centred around inaccuracy, and the potential for the mechanism to inspire non-productive activity such as generating spam or noise (Table 4.91). The primary causes of inaccuracy raised in the responses were due to the quantitative nature of the mechanism, which can only do so much to detect spam and noise, and the non-recognition of any activity outside of GroupShare.

Table 4.90 – Post-usage questionnaire, question 29 (N=36, optional open-ended question)

<b>Q29. Please comment on what you feel to be the <i>positive</i> impacts of the PA feature, if any. (Open-ended question)</b>
Displays participation of group members and make it easier to track/visualise, encourages activity and increased work, discourage and identify 'slacking off', synergy due to increased awareness, having a high participation score felt rewarding.

Table 4.91 – Post-usage questionnaire, question 30 (N=31, optional open-ended question)

<b>Q30. Please comment on what you feel to be the <i>negative</i> impacts of the PA feature, if any. (Open-ended question)</b>
Inaccuracy due to spam/noise or offline/assisted work, not all inclusive and depends on quantity rather than quality, focus shift to participation score rather than participation itself, encourage spam/noise, increase to stress/competition, feelings of guilt when participant could not log in for a while.

Three summary values were constructed from this section of the post-usage questionnaire. The first, Table 4.92, concerned the accuracy of the participation awareness mechanism. It revealed that 54% of participants found it accurate for both themselves and their group members, 21% found it inaccurate for both, and the remaining 25% being neutral or finding the mechanism accurate for one but not the other.

Table 4.92 – Summary value 5 (N=63)

Both:	Q19 positive , Q20 positive			
Self Only:	Q19 positive , Q20 negative or neutral			
Neutral:	Q19 neutral, Q20 neutral			
Others Only:	Q19 negative or neutral, Q20 positive			
None:	Q19 negative, Q20 negative (or one negative and one neutral response)			
<b>SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
13	2	7	7	34

The next summary value aimed to illustrate the impact that the participation awareness mechanism had on participants by aggregating the responses to questions 21, 22, 24 and 28. Question 25 was omitted from the value, as an increase or decrease in competitiveness cannot be qualified as either a positive or a negative impact. The value found that participation awareness had a positive impact for 63% of participants, with 24% neutral (Table 4.93).

Table 4.93 – Summary value 6 (N=63)

Likert-type responses assigned values of -2 (SD), -1 (D), 0 (N), 1 (A) and 2 (SA). Responses to questions 21, 22, 24, and 28 totalled (polarity switched for question 24 due to negative wording) to give a sum value between 8 and -8.				
Strongly Positive: Sum value of 8, 7, 6 or 5				
Mildly Positive: Sum value of 4, 3 or 2				
Neutral: Sum value of 1, 0 or -1				
Mildly Negative: Sum value of -2, -3 or -4				
Strongly Negative: Sum value of -5, -6, -7 or -8				
<b>SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	8	15	30	10

Finally, a summary value of overall participation awareness affinity was calculated, based on responses to questions 23, 26, 27 and 28. Similar to the prior summary value, this value found a positive affinity to participation awareness in 65% of participants, with 24% neutral (Table 4.94). No correlations or relationships were discovered between participant ages or genders and the summary values defined in this section. The participant profiles in Section 5.5 examine these summary values from numerous perspectives based on questionnaire responses, demographics and usage data.

Table 4.94 – Summary value 7 (N=63)

Likert-type responses assigned values of -2 (SD), -1 (D), 0 (N), 1 (A) and 2 (SA). Responses to questions 23, 26, 27, and 28 totalled to give a sum value between 8 and -8.				
Strongly Positive: Sum value of 8, 7, 6 or 5				
Mildly Positive: Sum value of 4, 3 or 2				
Neutral: Sum value of 1, 0 or -1				
Mildly Negative: Sum value of -2, -3 or -4				
Strongly Negative: Sum value of -5, -6, -7 or -8				
<b>SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
2	5	15	26	15

#### 4.4.4 Section 4 - Participation Awareness – Presentation Styles

This section concerned the four participation awareness presentation styles, as described in Section 3.6.2. In open-ended responses in the section, two participants stated they were unaware of the existence of multiple styles, and had therefore never changed from the default Simple Text style – a claim that was confirmed by the usage data. Both participants selected Simple Text for all questions where a single style was required and completed ranking questions in a ‘donkey vote’ manner – answering

sequentially with no respect to preference. Their responses were eliminated from this section of the questionnaire, leaving a sample of 61 participants.

The first question of the section asked how often participants switched between the different styles during the usage period, to which 67% of participants claimed they had switched on a monthly basis or never (Table 4.95). Examining the usage data reveals that most of these participants rapidly switched between all styles early in their usage period, before settling on a single style. Many then repeated this rapid switching on sporadic occasions throughout the usage period. This suggests that most participants had a favourite participation awareness presentation style, but occasionally viewed the other styles out of curiosity or while seeking information better represented in another style.

Table 4.95 – Post-usage questionnaire, question 31 (N=61)

<b>Q31. Approximately how often did you switch between different PA styles during the usage period?</b>				
Never	Monthly	Every two weeks	Weekly	More than weekly
30	11	4	5	11

Including participants who never switched presentation styles, the usage data revealed an average of 22 style switches per participant, although no strong relationships were found between the number of switches and factors such as GroupShare usage or importance placed on the participation awareness mechanism. One outlier was Participant 28, who switched styles 379 times – 259 times more than any other participant. Exhibiting the second highest level of GroupShare usage amongst all participants, Participant 28 switched between presentation styles most of the he used the application. In his open-ended response to question 29 of the post-usage questionnaire (Table 4.90), he stated:

PA was about the best thing of GroupShare and impressed me the most. It was also due to the fact that there were several models, not just the one diagram, or the one table (because there are many factors and things to consider). I regularly viewed each diagram and it helped me understand how the others were going and how i would rate each members performance.

Excluding Participant 28, the average number of style switches was 17.

The following three questions required a presentation style to be selected as a response. The Simple Graphics style was found to provide the best at-a-glance information at 52% of responses, followed by the Simple Text style at 30% (Table 4.96). Responses were quite evenly divided on the question of which gave the most useful information, with Simple Text receiving 30%, Complex Text receiving 28%, Simple Graphics receiving 23% and Complex Graphics receiving 20% of responses (Table 4.97). Unsurprisingly, the graphical styles were deemed the most visually appealing, in particular the Simple Graphics style at 64% of responses (Table 4.98).

Table 4.96 – Post-usage questionnaire, question 32 (N=61)

<b>Q32. Which PA style do you feel gave the best "at-a-glance" information, regardless of accuracy?</b>			
Simple Text	Simple Graphics	Complex Text	Complex Graphics
18	32	5	6

Table 4.97 – Post-usage questionnaire, question 33 (N=61)

<b>Q33. Which PA style do you feel provided the most useful information?</b>			
Simple Text	Simple Graphics	Complex Text	Complex Graphics
18	14	17	12

Table 4.98 – Post-usage questionnaire, question 34 (N=61)

<b>Q34. Which PA style did you find the most appealing, visually?</b>			
Simple Text	Simple Graphics	Complex Text	Complex Graphics
8	39	4	10

Questions 35 and 36 required the presentation styles to be ranked, using the same question format, validation and sanitisation of responses as questions 36 and 37 of the pre-usage questionnaire (Section 4.2.5). Invalid responses resulted in a sample size of 59 and 58 participants in questions 35 and 36 respectively. The questions concerned which presentation styles participants preferred (Table 4.99), and which styles they felt presented participation the most accurately (Table 4.100).

Table 4.99 – Post-usage questionnaire, question 35 (N=59)

<b>Q35. Which PA style did you most prefer? Please rank the PA styles in order of overall preference, with 1 being the most preferred.</b>				
	4 (Least Preferred)	3	2	1 (Most Preferred)
Simple Text	17	9	14	19
Simple Graphics	2	12	19	26
Complex Text	21	18	15	5
Complex Graphics	19	20	11	9

Table 4.100 – Post-usage questionnaire, question 36 (N=58)

<b>Q36. Which PA style did you feel presented you and your group members' participation the most accurately? Please rank the PA styles in order of accuracy, with 1 being the most accurate.</b>				
	4 (Least Accurate)	3	2	1 (Most Accurate)
Simple Text	15	13	10	20
Simple Graphics	9	14	24	11
Complex Text	15	15	13	15
Complex Graphics	19	16	11	12

Optional open-ended areas were once again available should participants wish to elaborate on their rankings. Responses to these consisted of individual justifications or explanations of a participant's ratings and general feedback, with no strong or recurring themes being identified. Table 4.101 and Table 4.102 present the average ranks, total points and overall ranks, calculated using the same formulas used in questions 36 and 37 of the pre-usage questionnaire (Section 4.2.5).

Table 4.101 – Preferred presentation style ranking totals (total sum of points = 590)

<b>Preferred presentation style ranking totals.</b>			
	Average Rank	Total Points	Overall Rank
Simple Text	2.41	153	2 <sup>nd</sup>
Simple Graphics	1.83	187	1 <sup>st</sup>
Complex Text	2.93	122	4 <sup>th</sup>
Complex Graphics	2.83	128	3 <sup>rd</sup>

Table 4.102 – Most accurate presentation style ranking totals (total sum of points = 580)

<b>Most accurate presentation style ranking totals.</b>			
	Average Rank	Total Points	Overall Rank
Simple Text	2.40	151	2 <sup>nd</sup>
Simple Graphics	2.36	153	1 <sup>st</sup>
Complex Text	2.52	144	3 <sup>rd</sup>
Complex Graphics	2.72	132	4 <sup>th</sup>

At 187 points (32%), the Simple Graphics style was found to be the most preferred overall, followed by Simple Text at 153 points (26%). In terms of accuracy, all of the presentation styles scored within 3% of each other. Curiously, the Simple Graphics style scored the highest despite receiving the lowest number of '1' rankings – the bulk of its score was due to receiving a large number of '2' rankings. Simple Text, which had a total score only two less than Simple Graphics, received the majority of the '1' rankings. Based on these figures, it appears that the two simple styles were clearer favourites in regards to accuracy than the closeness of the scores would suggest.



The section ended with an optional open-ended area for further comments regarding the presentation styles or the presentation of participation awareness in general (Table 4.103). Only nine participants completed the question, voicing general feedback and suggestions.

Table 4.103 – Post-usage questionnaire, question 37 (N=9, optional open-ended question)

<b>Q37. If you have any further comments regarding the PA styles or the <i>presentation</i> of PA that you feel are relevant, please write them below. (Open-ended question)</b>
General feedback, suggested changes to presentation of participation awareness.

Responses to questions 32 to 36 were combined in a summary value, in order to identify participants who expressed a clear favourite amongst the presentation styles by frequently selecting it and ranking it highest (Table 4.104). The value emphasises the preferences towards the simple styles, with Simple Graphics and Simple Text being favoured by considerably more participants than the complex styles. Participants who did not complete the ranking questions correctly (see Table 4.99 and Table 4.100) have been placed in the ‘No Clear Favourite’ category, as they did not exhibit a favourite amongst questions 32 to 34. The participant profiles in Section 5.5 examine this summary value from numerous perspectives based on questionnaire responses, demographics and usage data.

Table 4.104 – Summary value 8 (N=61)

Same presentation style selected or ranked ‘1’ in at least 4/5 of questions 32, 33, 34, 35 and 36.				
<b>SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
26	10	16	4	5

#### 4.4.5 Section 5 - Participation Awareness – Actions and Metrics

The last section of the post-usage questionnaire began by asking participants if they had read information regarding the participation awareness mechanism available in GroupShare. Although 70% of participants had not read the information (Table 4.105), 75% felt that they had a reasonable understanding of how the mechanism worked (Table 4.106). Of the 47 participants who felt they understood how the mechanism worked, 31 (66%) had not read information regarding it.

Table 4.105 – Post-usage questionnaire, question 38 (N=63)

<b>Q38. I read information (e.g. the PA help topic or glossary) in order to better understand the PA feature.</b>	
No	Yes
44	19

Table 4.106 – Post-usage questionnaire, question 39 (N=63)

<b>Q39. I had a reasonable understanding how the PA feature worked, and what actions influenced it.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4	4	8	33	14

A total of 67% (24% neutral) of participants felt that the actions which influenced the participation awareness mechanism were appropriate (Table 4.107), and 44% (44% neutral) felt that their actions influenced the mechanism as they expected (Table 4.108).

Table 4.107 – Post-usage questionnaire, question 40 (N=63)

<b>Q40. I feel that the actions which influenced the PA feature were appropriate.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	5	15	34	8

Table 4.108 – Post-usage questionnaire, question 41 (N=63)

<b>Q41. I feel that my actions did <i>not</i> influence the PA feature in the way I expected.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	27	28	5	2

Five participants responded positively to both question 40 and 41, which was negatively worded. While the wording of the questions does not make such responses ‘contradictory’, a brief examination of these responses is worthwhile due to the similar nature of the questions. Of the five participants who answered in this manner, one mentioned in an open-ended response later in the same section that everything “worked in the manner I thought it would” (Participant 14), while the other four provided no further responses to further explain their position. The author concedes that is possible the negative wording of question 41 was not noticed by some participants, perhaps influenced by the questions’ position towards the end of the questionnaire.

Question 42 asked participants if any actions influenced the mechanism more or less than they expected, to which 71% of participants responded neutrally (Table 4.109).

An optional open-ended area was available for participants to provide further details regarding this question. Ten participants did so, most of which felt that passive actions such as logging in and viewing work were rewarded too highly. It was also suggested that downloading and commenting on files were rewarded too highly, as the actions were easy to perform and not necessarily useful to the group (Table 4.110).

Table 4.109 – Post-usage questionnaire, question 42 (N=63)

<b>Q42. I feel that certain actions influenced the PA feature more or less than I expected.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	7	45	10	0

Table 4.110 – Post-usage questionnaire, question 42a (N=10, optional open-ended question)

<b>Q37. If you have any further comments regarding the PA styles or the <i>presentation</i> of PA that you feel are relevant, please write them below. (Open-ended question)</b>
Passive actions rewarded too highly, easy to perform actions often inane and rewarded too highly.

The next two questions concerned the ratings which participants could give to shared files and forum threads in GroupShare. As evidenced in the usage data, many participants did not make heavy use of the rating feature, with 40%, stating that they made an effort to rate their group members’ files and threads, and 40% stating that they did not (Table 4.111). Responses were also divided regarding how much impact ratings should have on the participation awareness mechanism, with 39% of participants being neutral, 32% feeling they should have less impact, and 29% feeling they should have a greater impact (Table 4.112).

Table 4.111 – Post-usage questionnaire, question 43 (N=63)

<b>Q43. I made an effort to rate the shared files and/or forum threads of other group members.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
10	15	13	19	6

Table 4.112 – Post-usage questionnaire, question 44 (N=63)

<b>Q44. I feel that ratings should have a larger impact on the PA feature.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4	16	25	12	6

Knowing that the mechanism relied primarily on the number of actions rather than their quality influenced 62% (29% neutral) of participants’ perception of the feature’s accuracy (Table 4.113). Responses were divided regarding how suitable the participation awareness metrics were in reflecting the overall quality of group member participation, with 40% positive, 38% neutral, and 22% negative (Table 4.114).

Table 4.113 – Post-usage questionnaire, question 45 (N=63)

<b>Q45. Knowing that the PA feature relied mostly on the number of actions rather than their "quality" influenced my perception of the feature's accuracy.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	5	18	28	11

Table 4.114 – Post-usage questionnaire, question 46 (N=63)

<b>Q46. I found that the actions which influenced the PA feature suitably reflected the overall quality of my group members' participation.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3	11	24	21	4

An open-ended area was available for participants to make further comments regarding the metrics of the participation awareness mechanism (Table 4.115). Some participants mentioned aspects of the participation awareness metrics which they felt lessened its accuracy, such as the potential for spam and noise and the quantitative nature of the mechanism.

Table 4.115 – Post-usage questionnaire, question 47 (N=13, optional open-ended question)

<b>Q47. If you have any further comments regarding the <i>actions and metrics</i> of the PA feature that you feel are relevant, please write them below. (Open-ended question)</b>
General feedback, potential inaccuracy due to spam/noise, passive/indirect actions may not represent useful contribution, reliance on quantity over quality, rating better suited to larger groups.

## **4.5 Post-Usage Questionnaire Summary**

The post-usage questionnaire sought feedback regarding GroupShare and the participation awareness mechanism. Four summary values were created (Table 4.116), covering the primary areas of interest explored in the post-usage questionnaire.

Table 4.116 – Post-usage questionnaire summary values (N=63 for A-C, N=61 for D)

A. SV5. Participation Awareness Accuracy				
None	Others Only	Neutral	Self Only	Both
13	2	7	7	34

B. SV6. Participation Awareness Impact				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	8	15	30	10

C. SV7. Participation Awareness Affinity				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
2	5	15	26	15

D. SV8. Favourite Presentation Style				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
26	10	16	4	5

To assist in visualising these values, they have been presented graphically in Figure 4.2.

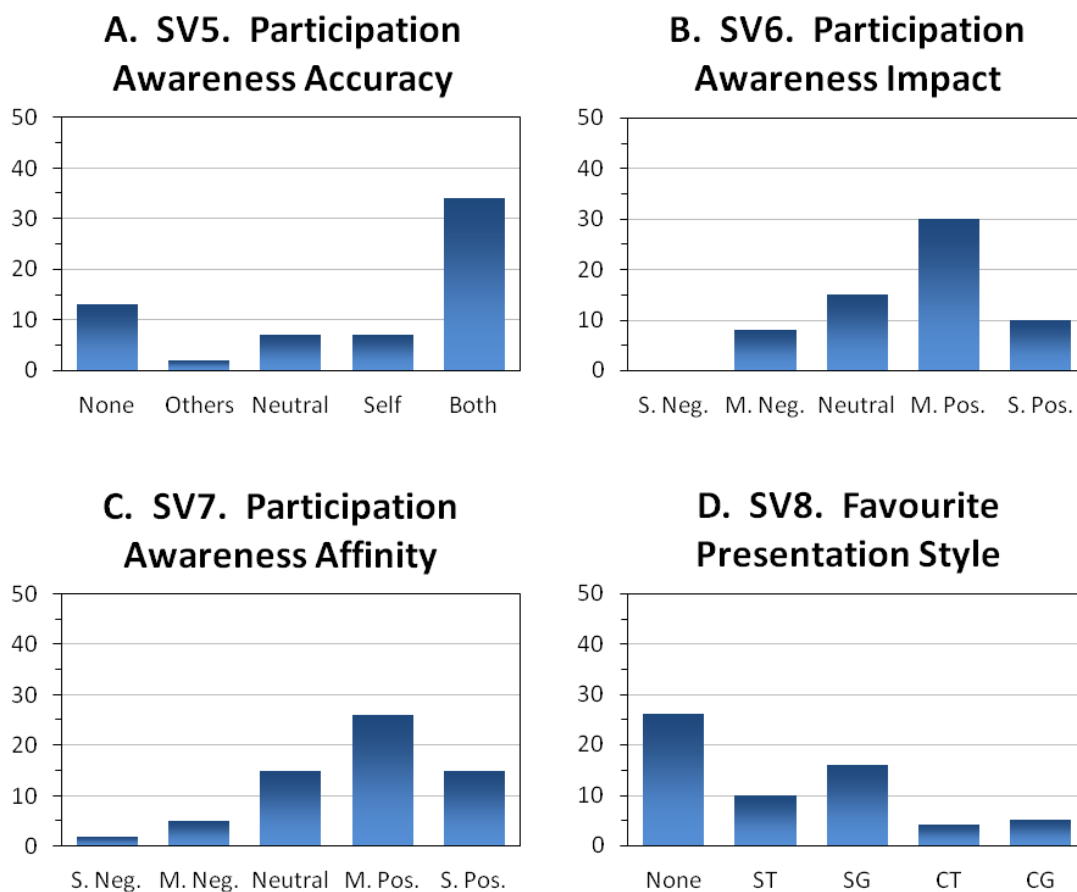


Figure 4.2 – Post-usage questionnaire summary values (N=63 for A-C, N=61 for D)

## 4.6 Staff Questionnaire

Teaching staff lecturing the units that participated in the research were asked to complete the staff questionnaire towards the end of their unit's usage period, with a reminder being sent via e-mail towards the end of the semester. Discounting a 'General Use' unit established in GroupShare during the main iteration of the research, four different units participated in the research. Three of these units participated in both instances of the research, resulting in a total of seven instances of units delivered by four teaching staff. Details of participating units are presented in Section 5.1. The staff questionnaire received two responses in the pilot iteration of the research, and one response in the main iteration. Two of the responses were from the same staff member, whose unit participated in both iterations of the research. As the responses reflect upon different instances of the unit, the author feels it is valid to utilise them both. While the number of responses was too small for the purposes of statistical analysis and generalisation, the staff questionnaire was useful as a supplementary data source – providing thoughts and experiences regarding group work and participation from a staff perspective.

Due to the number of responses, the following sub-sections utilise a slightly different format than that used for the pre-usage and post-usage questionnaires, in order to examine the responses as distinct 'cases' rather than a purely quantitative response sets. The three responses have been labelled A, B1 and B2 – with B1 and B2 representing the responses from the same staff member in the pilot and main iteration respectively. To align responses with the unit labels defined in Figure 3.4 and Section 5.1, response A was from the teaching staff of unit P2, B1 was of P1 and B2 was of M3. This is illustrated in Table 4.117.

Table 4.117 – Staff questionnaire responses and units

Unit P1	Unit P2	Unit M3
B1	A	B2

Responses will be discussed in terms of individual staff members, rather than in a numerical manner. The term 'staff participants' has been used in the following sub-sections to refer to the staff questionnaire respondents in general. To avoid

ambiguity, the 63 students who provided complete data sets and have previously been referred to as participants will be referred to as 'student participants' in the following sub-sections.

#### 4.6.1 Section 1 - Participation in Prolonged Group Work

Questions 1 and 2 (Table 4.118 and Table 4.119) provide parallels to questions 18 and 15 in the pre-usage questionnaire administered to students (Table 4.24 And 4.21). The findings correlate, with staff participants recognising the student participants' preference for individual work over group work, and their usage of online communicative and collaborative methods regardless of the availability of face-to-face contact.

Table 4.118 – Staff questionnaire, question 1 (N=3)

<b>Q1. I find that most students prefer prolonged group work above individual work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1 (A)	1 (B1)	1 (B2)	0	0

Table 4.119 – Staff questionnaire, question 2 (N=3)

<b>Q2. In my experience, students often use online methods to communicate and collaborate with their group, even when studying on campus.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	0	0	3 (A, B1, B2)	0

Staff member A expressed difficulty in gaining a clear understanding of individual student participation both during group work and when assessing its outcomes. Staff member B expressed the opposite in both responses (Table 4.120 and Table 4.121). Responses were divided in regards to discovering problems in student groups, however both staff members reported only becoming aware of such problems when brought up by a student (Table 4.122).

Table 4.120 – Staff questionnaire, question 3 (N=3)

<b>Q3. I find it difficult to have a good understanding of individual student participation in prolonged group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	2 (B1, B2)	0	0	1 (A)

Table 4.121 – Staff questionnaire, question 4 (N=3)

<b>Q4. I find it difficult to determine if students have participated equally when assessing the outcomes of prolonged group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	2 (B1, B2)	0	0	1 (A)

Table 4.122 – Staff questionnaire, question 5 (N=3)

<b>Q5. The first time I usually hear about a problem in a group is when one of the members comes to me regarding it.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	1 (B2)	0	2 (A, B1)	0

Questions 6 and 7 allowed staff participants to specify the measures they used to ensure participation during group work (Table 4.123) and to check it at the completion of the group work (Table 4.124). Staff member A participated in weekly meetings with student groups, and required them to submit weekly status reports. Confidential peer reviews of group members were submitted by students at the end of semester. Staff member B conducted weekly tutorial sessions with students in their groups, and also informed groups that they had the autonomy to exclude non-participating group members from their final submissions if they felt it was appropriate. Students in staff member B’s unit were also required to complete a reflective piece at the end of the unit, covering their thoughts and experiences with the group work and GroupShare.

Table 4.123 – Staff questionnaire, question 6 (N=3) & 6a (N=3, conditional open-ended question)

<b>Q6. I have measures in place to help ensure student participation <i>during</i> prolonged group work.</b>	
No	Yes
0	3 (A, B1, B2)
<b>Q6a. If you answered yes to the previous statement, please specify. (Open-ended question)</b>	
A. Weekly meetings and status reports.	
B1. Weekly group tutorial sessions, working closely with groups, students complete reflective pieces on group work experiences, groups able to exclude non-participants from submission if they feel it is appropriate.	
B2. Checking usage of GroupShare.	

Table 4.124 – Staff questionnaire, question 7 (N=3) & 7a (N=3, conditional open-ended question)

<b>Q7. I have measures in place to help check student participation <i>at the completion of</i> prolonged group work.</b>	
No	Yes
0	3 (A, B1, B2)
<b>Q7a. If you answered yes to the previous statement, please specify. (Open-ended question)</b>	
A. Measures listed in Q6a, confidential peer reviews.	
B1. Measures listed in Q6a, emphasis on reflective pieces.	
B2. Students complete reflections on group work.	



Staff participants made use of several factors to form an initial perception of a student's participation in group work (Table 4.125). Class attendance and personal observation played a part, as did activity in GroupShare.

Table 4.125 – Staff questionnaire, question 8 (N=3, open-ended question)

<b>Q8. What factors do you tend to use to form an initial perception of a student's participation in group work? (Open-ended question)</b>
A. Class attendance, weekly meetings, personal observation, status reports.
B1. Class attendance, participation in group tutorial sessions, activity in GroupShare, reflective pieces.
B2. Group dynamics, personal observation during tutorial sessions, activity in GroupShare.

## 4.6.2 Section 2 - Participation Awareness

This section concerned participation awareness, which staff participants had been introduced to discussions with the author, and during the overview of the research and demonstration of GroupShare conducted in each unit at the beginning of its usage period. Staff participants had the ability to view the participation mechanism in action throughout the usage period via GroupShare's staff interface, which allowed them to view groups in their unit. Staff participants felt that a display of participation awareness in a groupware application would benefit them in assessing group work (Table 4.126). Staff member B felt that the mechanism could have a negative impact on some groups or individuals who thought that it was assessable, which could cause antagonism towards students deemed to be submitting quantity over quality (Table 4.127). The need to clearly document the intent, capabilities and accessibility of participation awareness is discussed in upcoming chapters.

Table 4.126 – Staff questionnaire, question 9 (N=3)

<b>Q9. I feel that a display of participation awareness in a groupware system would benefit me in assessing student participation in prolonged group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	0	0	3 (A, B1, B2)	0

Table 4.127 – Staff questionnaire, question 10 (N=3) & 10a (N=1, conditional open-ended question)

<b>Q10. I feel that a display of participation awareness in a groupware system may have a negative impact on some groups/individuals.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	-1 (A)	1 (B1)	1 (B2)	0
<b>Q10a. If you agreed or strongly agreed with the previous statement, please specify (Open-ended question)</b>				
B2. Potential for students to think participation awareness is sole measure of participation and/or will be assessed, causing antagonism towards those who post quantity over quality.				

Both staff participants felt that a participation awareness mechanism could encourage students to be more active in their group (Table 4.128), and that overall it could be beneficial to students (Table 4.129). These responses reflect the findings of questions 21 and 28 in the post-usage questionnaire (Table 4.82 and 4.89), in which student participants indicated that the participation awareness mechanism encouraged them to be more active in their group and had an overall positive effect.

Table 4.128 – Staff questionnaire, question 11 (N=3)

<b>Q11. I feel that a display of participation awareness in a groupware system may encourage students to be more active in their group.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	0	0	3 (A, B1, B2)	0

Table 4.129 – Staff questionnaire, question 12 (N=3)

<b>Q12. Overall, I feel that a display of participation awareness in a groupware system could benefit students in prolonged group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	0	0	3 (A, B1, B2)	0

Question 13 (Table 4.130) asked if staff participants had used GroupShare’s staff interface to view student groups during the semester. Staff member B did so in both iterations, while staff member A did not. In parts a and b of question 13, staff member A reported finding the participation awareness mechanism easy to understand, and that it reflected her own perceptions regarding the participation of students.

Table 4.130 – Staff questionnaire, question 13 (N=3), 13a (N=2) & 13b (N=2)

<b>Q13. Did you use GroupShare's staff interface to view student groups during the semester?</b>		
No	Yes	
1 (A)	2 (B1, B2)	
<b>If you answered yes to the previous question, please complete the following two questions.</b>		
<b>Q13a. Did you find the participation awareness feature easy to understand?</b>		
No	Did not notice	Yes
0	0	2 (B1, B2)
<b>Q13b. Did the participation awareness feature reflect your own perceptions regarding the participation of students?</b>		
No	Did not notice / Did not have pre-existing perceptions	Yes
0	1 (B2)	1 (B1)

All staff participants indicated that they would be willing to use GroupShare to support group work in their units in the future (Table 4.131). Students provided some feedback to staff members during the usage period, relating to GroupShare and the

participation awareness mechanism (Table 4.132). The feedback primarily concerned GroupShare’s interface and the participation awareness mechanism.

Table 4.131 – Staff questionnaire, question 14 (N=3)

<b>Q14. I would be willing to use GroupShare again in the future to support prolonged group work in my classes (unrelated to research).</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	0	0	2 (A, B1)	1 (B2)

Table 4.132 – Staff questionnaire, question 15 (N=3, optional open-ended question)

<b>Q15. If students gave you feedback regarding the participation awareness feature or GroupShare in general which you feel could be relevant, please summarise it below. (Open-ended question)</b>
A. Students found GroupShare to be useful and user friendly.
B1. Students recognised that participation awareness mechanism cannot capture the quality of contributions, but many did not understand that actions such as logging in had a smaller impact than direct contribution.
B2. Students liked many aspects of GroupShare’s interface.

### 4.6.3 Section 3 - Aspects of Participation

The final section of the staff questionnaire also contained some questions with parallels in the student pre-usage questionnaire. Question 16 asked staff participants if they believed that indirect participation is an important element of group work (Table 4.133), to which all staff participants responded positively. This reflects question 34 of the pre-usage questionnaire, which asked student participants if they felt participation in group work involved more than the direct contribution of work and received an 84% positive response (see Table 4.44).

Table 4.133 – Staff questionnaire, question 16 (N=3)

<b>Q16. I believe that indirect participation (that which does not involve directly contributing work) is an important element of prolonged group work.</b>				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
0	0	0	2 (B1, B2)	1 (A)

The next question asked staff participants to indicate how important they felt five different aspects of direct and indirect participation in group work were, using a modified Likert scale (Table 4.134). All aspects were rated as important, however communicating with other group members in a social manner was deemed slightly less important than the other aspects – a view which is reflected by student participants’ responses to question 37 of the pre-usage questionnaire (Table 4.47).

Table 4.134 – Staff questionnaire, question 17 (N=3)

<b>Q17. Please indicate how important you feel it is for students to demonstrate the following things when participating in prolonged group work.</b>					
	Very Unimportant	Unimportant	Neutral	Important	Very Important
<b>17a.</b> Contributing work to the group.	0	0	0	1 (B1)	2 (A, B2)
<b>17b.</b> Communicating with other group members in a work-related manner.	0	0	0	1 (B2)	2 (A, B1)
<b>17c.</b> Communicating with other group members in a social manner.	0	0	0	2 (A, B2)	1 (B1)
<b>17d.</b> Remaining up-to-date with the overall status of the project and the work of other group members.	0	0	0	1 (B2)	2 (A, B1)
<b>17e.</b> Providing feedback on the work of other group members.	0	0	0	1 (B1)	2 (A, B2)

An open-ended question asked staff participants to identify what they felt were the most important skills or qualities for students to demonstrate when participating in group work (Table 4.135). Staff member A advocated the need for students to make an appropriate effort, while staff member B felt that time management and effective communication skills were very important.

Table 4.135 – Staff questionnaire, question 18 (N=3, open-ended question)

<b>Q18. What do you feel are the most important skills or qualities that a student must demonstrate when participating in prolonged group work? (Open-ended question)</b>
A. Putting in the effort.
B1. Time management, teamwork, written and oral communication skills, presentation skills.
B2. Time management, conflict resolution, effective communications.

Staff member A reported often receiving a range of complaints from students regarding their group members (Table 4.136). Staff member B received such complaints less frequently, although she mentioned two other complaints received from students - Dominant team members forcing their own work methods onto the rest of the group, and total failure by group members to participate in or attend group work (Table 4.137).

Table 4.136 – Staff questionnaire, question 19 (N=1, optional open-ended question)

<b>Q19. Please indicate how often you typically receive the following complaints from your students.</b>					
	Never	Rarely	Sometimes	Often	Frequently
<b>19a.</b> Group member not contributing work in timely manner, or not at all.	0	0	2 (B1, B2)	1 (A)	0
<b>19b.</b> Group member not communicating or remaining in contact with group.	0	0	2 (B1, B2)	1 (A)	0
<b>19c.</b> Group member contributions are of low quality, or of inappropriate length/content.	0	2 (B1, B2)	0	1 (A)	0
<b>19d.</b> Group member not remaining up-to-date on status of work and submissions of others.	0	1 (B1)	1 (B2)	1 (A)	0

Table 4.137 – Staff questionnaire, question 20 (N=3)

<b>Q20. What other complaints relating to prolonged group work have you received from students, if any? (Open-ended question)</b>
B2. Dominant team members forcing their own way of working, total failure to participate/attend.

## 4.7 Staff Questionnaire Summary

Despite receiving only three responses, the staff questionnaire was still able to capture some thoughts and experiences regarding group work and participation from a staff perspective. As the sample is obviously too small for statistical analysis or any kind of generalisation, responses were treated on a case-by-case basis, providing insights into the perspectives of staff members with extensive experience in administering and managing group-based work. As described, several correlations were found between staff and student responses. As it was a supplementary data source focused upon a secondary group of participants, no summary values were derived from the staff questionnaire.

This concludes the initial examination of quantitative data gathered in the research. The pre and post-usage questionnaire form the primary data source of the research, with the staff questionnaire serving a suitable supplementary data source. Evident in the questionnaire responses are an overall positive response to both GroupShare and the participation awareness mechanism. The data is further utilised, in conjunction with usage data and qualitative data sources, in further chapters, which investigate the field study environment and gathered data from various units of analysis and perspectives.

## **Chapter 5 – Unit, Group and Participant Profile Analysis**

In this chapter, data gathered via log-based observation and the questionnaires is utilised in order to examine the different units of analysis (Babbie, 2004, pp. 94-100) in order to gain a more thorough and holistic understanding of the field study environment and data collected. Each participating unit is introduced and summarised, a number of groups are analysed, and participant profiles are presented. The examination of units and groups utilises all available usage and questionnaire data, even that which comes from incomplete data sets, in order to present as complete a representation as possible. Participant profiles only utilise data from students who provided complete data sets.

### ***5.1 Units***

This section details the university units from which participants were drawn for the research. As detailed in Section 3.3, support was requested from teaching staff delivering units which featured a substantial amount of group work. Support was requested in either an 'opt in' manner or an 'opt out' manner. In both modes, the author visited the units to introduce the research and demonstrate GroupShare. In units providing 'opt in' support, students were asked to use GroupShare and participate in the research, while in 'opt out' units, GroupShare was integrated into the unit as the standard online group work environment, and students were able to opt out of the research and/or usage of the application. Three staff members offered support in the pilot study, and four offered support in the main study. Additionally, a 'General Use' unit was established during the main study to cater for groups of participants from other units. Table 5.1 and Table 5.2 provide an overview of the units in both iterations of the research. Consistent with the naming in Figure 3.4, units in the pilot study have been dubbed P1 to P3, and units in the main study have been dubbed M1 to M5. These labels are applied consistently through all chapters. The 'User Count' field of the tables indicates the number of students with an active enrolment in a group within that unit, and how many of these provided a full data set and were hence labelled as participants.

Table 5.1 – Overview of units in pilot study

<b>P1</b>	
Unit Title:	Information Services Management
Support Type:	Opt Out
Usage Period:	Weeks 1 – 13 (End of Semester)
User Count:	42 students (14 participants)

<b>P2</b>	
Unit Title:	Project Methods & Professionalism
Support Type:	Opt In
Usage Period:	Weeks 6 – 13 (End of Semester)
User Count:	45 students (4 participants)

<b>P3</b>	
Unit Title:	Systems Analysis
Support Type:	Opt In
Usage Period:	Weeks 2 – 13 (End of Semester)
User Count:	25 students (8 participants)

Table 5.2 – Overview of units in main study

<b>M1</b>	
Unit Title:	Project Management Methodology
Support Type:	Opt In
Usage Period:	Weeks 2 – 13 (End of Semester)
User Count:	6 students (1 participant)

<b>M2</b>	
Unit Title:	Systems Analysis
Support Type:	Opt In
Usage Period:	Weeks 2 – 13 (End of Semester)
User Count:	39 students (14 participants)

<b>M3</b>	
Unit Title:	Information Services Management
Support Type:	Opt Out
Usage Period:	Weeks 3 – 13 (End of Semester)
User Count:	61 students (17 participants)

<b>M4</b>	
Unit Title:	General Use
Support Type:	Opt In (by request)
Usage Period:	Weeks 3 – 13 (End of Semester)
User Count:	9 students (1 participant)

<b>M5</b>	
Unit Title:	Project Methods & Professionalism
Support Type:	Opt In
Usage Period:	Weeks 7 – 13 (End of Semester)
User Count:	52 students (5 participants)

The total number of participants indicated in the preceding tables is 64, one more than the 63 participants who provided a complete data set described in Chapter 4. This is due to the fact that one participant was enrolled in two supporting units in the main study – M3 and M5. While this participant has been counted once for individual analysis and questionnaire responses, his group enrolments have been treated independently for the purpose of group and unit-based analysis. The participant provided a single response to both the pre and post-usage questionnaire.

All units displayed some usage of GroupShare after the final week of semester, when all usage periods drew to a close. Such usage was substantially lower than usage during the 13 teaching weeks, and usually petered out within a few weeks. The actions performed during this time were primarily logging in and downloading files (Table 5.3), presumably in order to obtain a local copy once the author announced that GroupShare content would be erased before the start of the next semester.

Table 5.3 – Actions performed after end of semester (both iterations)

Action	#	%
view_home	1302	33%
login	652	17%
view_file	631	16%
download	531	9%
logout	270	7%
Sum of all other actions	538	14%

The following sub-sections provide a summary of each unit, illustrated by a graph depicting the unit’s usage of GroupShare. The Y-axis in these graphs, ‘Points’, represents the weekly sum of Contribution, Communication and Activity points received by all students in groups within each unit, utilising the point allocations listed in Table 3.6. In order to depict usage in a ‘raw’ manner, the limits listed in Table 3.7 have not been applied to the following graphs. Versions of these graphs with the limits applied have been provided in Appendix N. To facilitate comparison between units, all graphs have been presented within the same range of points and time.

### 5.1.1 Unit P1 Summary

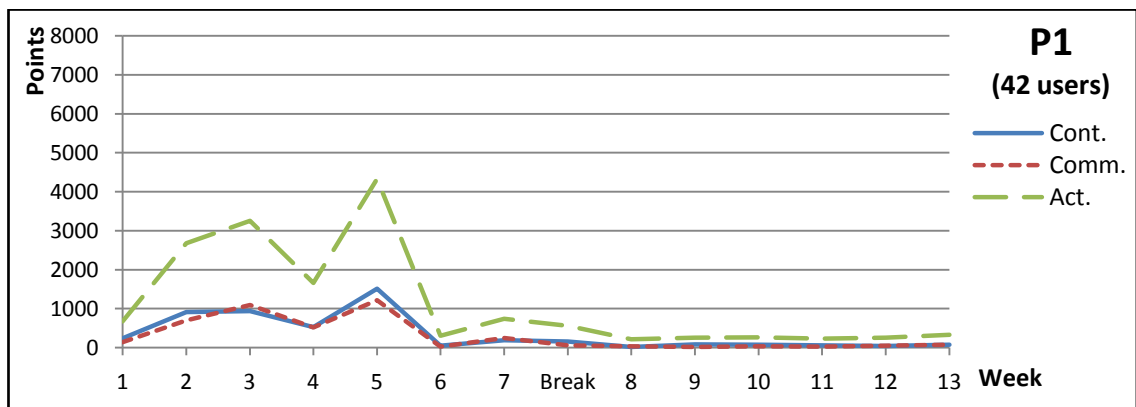


Figure 5.1 – P1 GroupShare usage

While students in P1 (Figure 5.1) were encouraged to continue working and sharing resources as a group throughout the semester, the assessable group work component of P1 was due in week five. The group work involved the discussion of a number of case study scenarios, and the development of responses to them. Usage of GroupShare was largely discontinued after this stage, with the majority of subsequent usage being passive actions such as logging in and viewing various parts of the system. Live chat and message board usage was also evident after week five, suggesting that



some students continued to use GroupShare to communicate with their group members. Almost all Contribution points received after week five were due to students viewing and downloading files.

As part of their assessable work, students in P1 were each required to complete a reflective piece about their experiences in the unit. The pieces included reflections on working as a group and working in GroupShare. The teaching staff of P1 provided the pieces, in an anonymised form, to the author as a supplementary data source. These reflections are examined in Chapter 6.

### 5.1.2 Unit P2 Summary

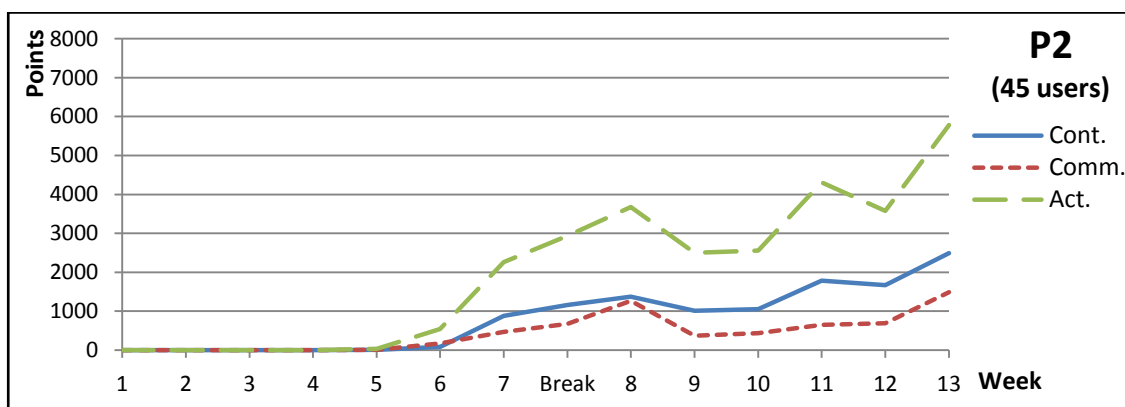


Figure 5.2 – P2 GroupShare usage

P2's (Figure 5.2) group work component began in week six and continued to the end of semester, with the final submission due in week 13. Group-based assessable items involved the development of a Web site, a presentation, and supporting documentation. GroupShare was consistently used throughout the usage period, with spikes in usage in weeks where deliverables were due for submission. Contribution remained above communication by a considerable margin through almost the entire the usage period, suggesting that students in P2 made more use of collaborative features such as file submission and commenting rather than purely communicative ones such as the message board and live chat. As the nature of the assignment involved the production of a large document, high use of collaborative features typically indicates that groups of students worked in a loosely-coupled manner, dividing the task between group members and communicating as required (Grudin &

Poltrock, 1997, p. 293). Activity remained substantially higher than Contribution through the usage period, suggesting a large number of passive actions. Once the semester ended, Activity dropped to below 250. Despite the high level of usage by 45 students, only four of them completed both the pre and post-usage questionnaires.

### 5.1.3 Unit P3 Summary

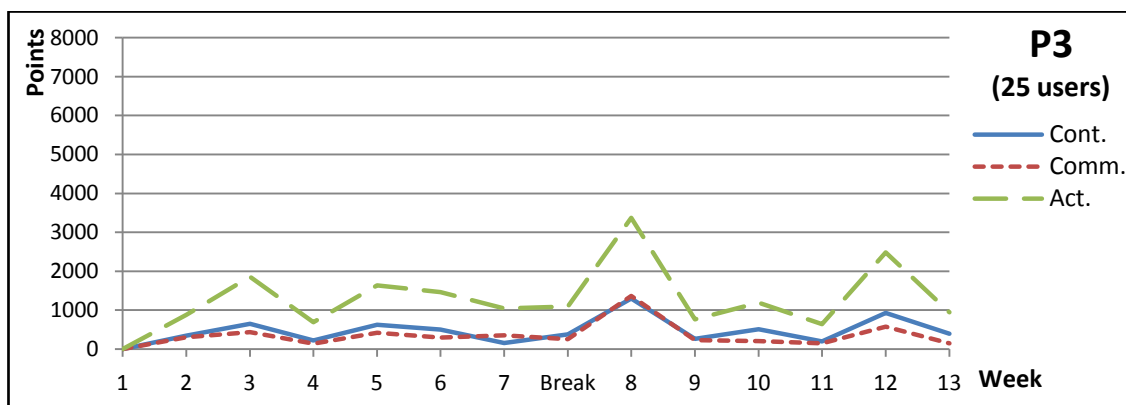


Figure 5.3 – P3 GroupShare usage

Group work was a major part of P3 (Figure 5.3), with students working on a group project throughout the semester. The group work involved the production of a lengthy project proposal, and a group presentation. GroupShare was consistently used throughout the usage period, with Figure 5.3 showing usage spikes in weeks where deliverables were due for submission. While the absolute level of usage appears lower in this unit than in P1 and P2, it is worth noting that there were substantially fewer students in P3, and usage was sustained throughout the semester.

### 5.1.4 Unit M1 Summary

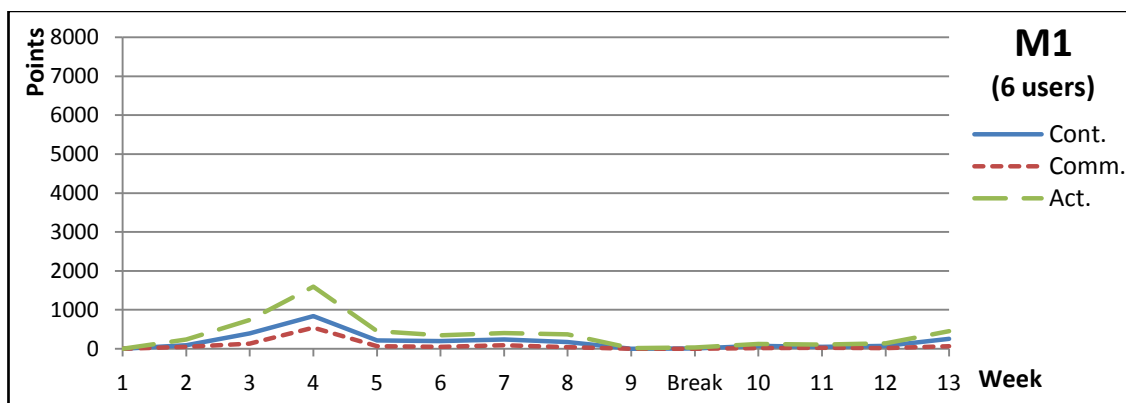


Figure 5.4 – M1 GroupShare usage

M1 (Figure 5.4) was a unit offered outside of the author’s department, in a department considerably less technology-oriented than the department from which other participating units were drawn. Only one group of students in P1 opted to participate in the research, resulting in six students, one of which provided a complete data set. Despite the low numbers, the group used GroupShare throughout the semester to complete a project which involved the development of a Web site and a group presentation. The majority of work was completed in week four, while a small rise in usage in week 13 was caused by group members finalising their project and downloading a local backup.

### 5.1.5 Unit M2 Summary

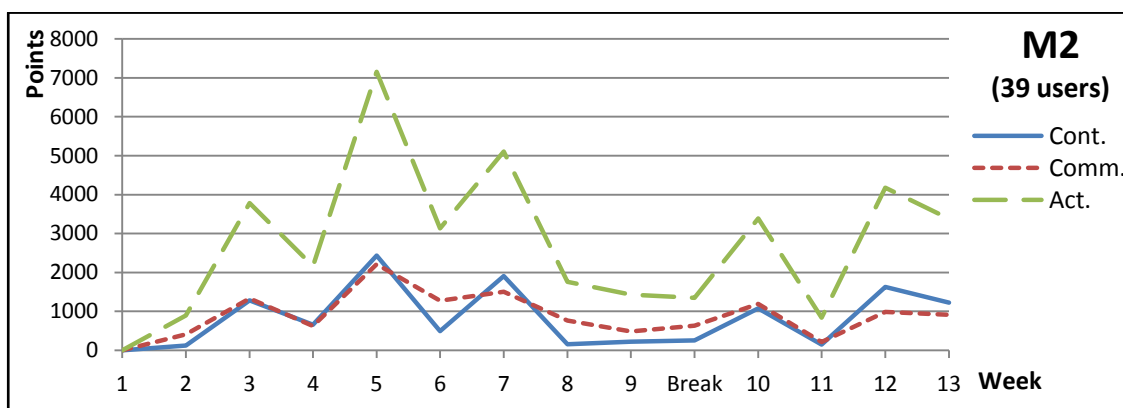


Figure 5.5 – M2 GroupShare usage

M2 (Figure 5.5) was the same unit as P3 (Section 5.1.3), once again involving a semester-long group work project in which students produced a lengthy project proposal and gave a group presentation. GroupShare was used heavily throughout the semester, particularly in the first half. The difference between Activity and the closely grouped Contribution and Communication indicate a high number of passive actions such as logging in and viewing parts of the system. Activity dropped to below 500 after the final teaching week. While the greater number of students in M2 partially accounts for its comparatively higher level of usage than that seen in P3, examination of usage data reveals that participants in M2 were also more active within GroupShare – generating an average total Contribution, Communication and Activity score 28% higher than seen in P3. However, participants in P3 had a slightly higher ratio of Contribution points to Activity points, which can be seen in the graphs of these units.

### 5.1.6 Unit M3 Summary

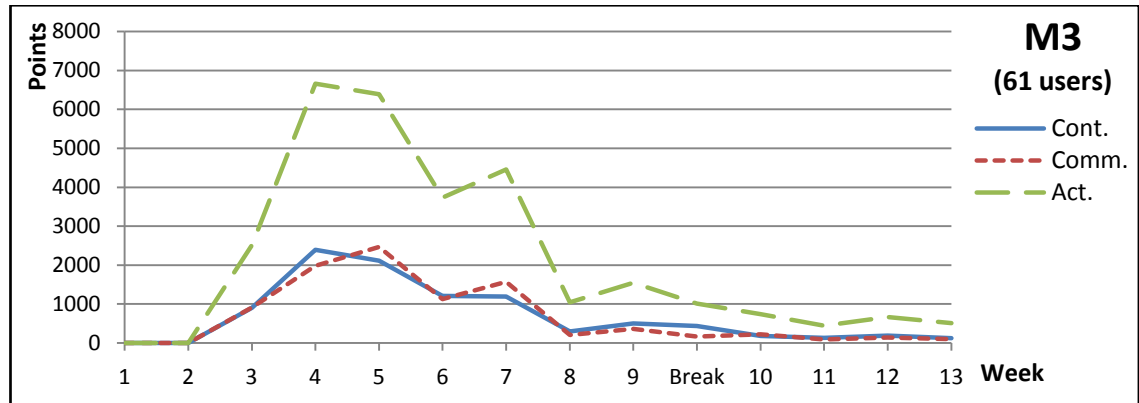


Figure 5.6 – M3 GroupShare usage

M3 (Figure 5.6) was the same unit as P1 (Section 5.1.1), and displayed a similar pattern of usage. The assessable group work of the unit was due in week seven, with GroupShare usage falling dramatically afterwards. The assessable group work was of the same nature as the P1 instance, with students discussing and producing responses to case study scenarios. Once again, some students continued to use GroupShare for group communication in the latter half of the semester, and a considerable number of files and comments were produced, indicating that some students continued to collaborate via GroupShare. As in other units, the high number of Activity points indicates many passive actions. Demographic data reveals that all bar one of the 10 participants who studied their participating unit online were in this unit, and that these participants were primarily females above 30 years of age. No distinct usage patterns were observed amongst the online participants.

As in P1, students in M3 were required to complete a reflective piece regarding their experiences in the unit. These were anonymised and offered to the author as supplementary data, and are examined in Chapter 6.

### 5.1.7 Unit M4 Summary

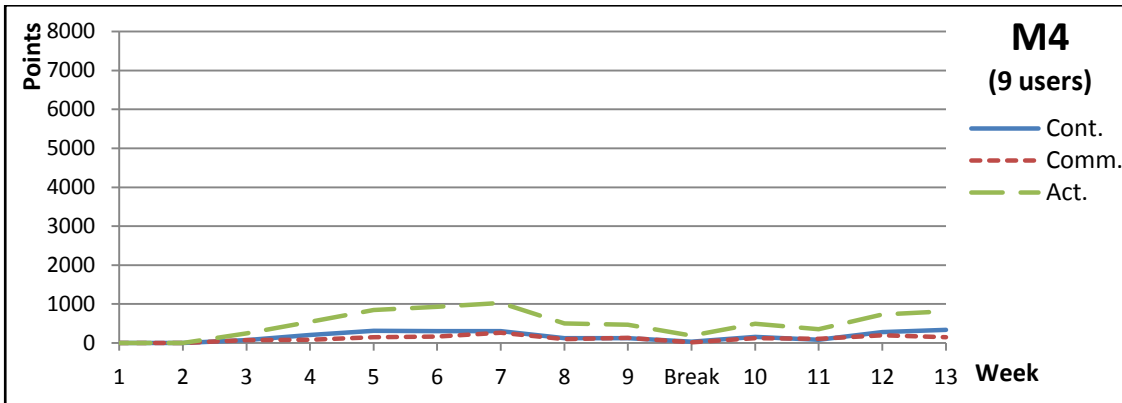


Figure 5.7 – M4 GroupShare usage

M4 (Figure 5.7) was a general use unit, established to cater for two groups of students in non-participating units who wished to use GroupShare after having used it in a participating unit. Usage was fairly consistent throughout the semester, however due to the low sample size and disparate origins of the groups, no trends can be observed.

### 5.1.8 Unit M5 Summary

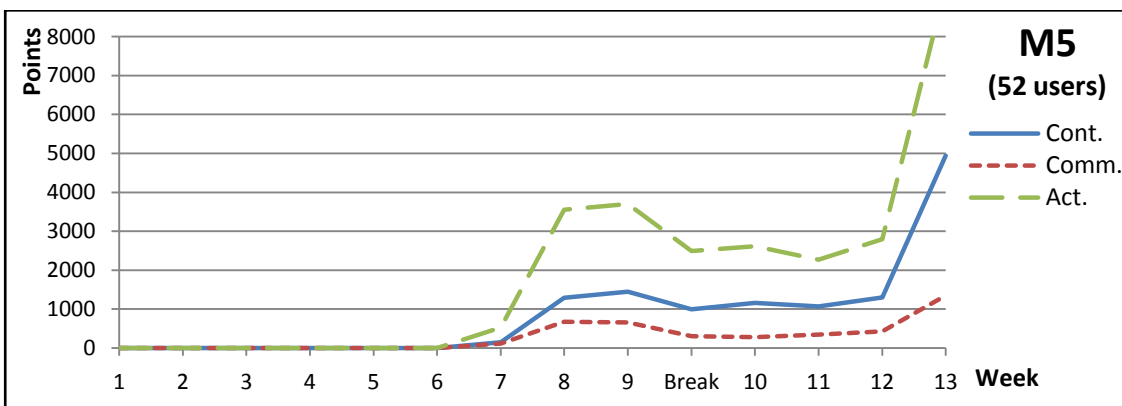


Figure 5.8 – M5 GroupShare usage

M5 (Figure 5.8) was the same unit as P2 (Section 5.1.2), and displayed a similar pattern of usage. Group work was only required in the latter half of the semester, and again consisted of a well-documented project and presentation. GroupShare saw substantial usage from week seven onwards, the beginning of the group work component. The final deliverable was due in week 13, clearly depicted by a spike of 9305 in Activity and 4940 in Contribution. Activity dropped to below 500 in the following week, and Contribution to below 100. As in P2, Contribution points remained considerably higher than Communication points throughout the usage period.

## ***5.2 Unit Summary and Trends***

The differing number of students in each unit resulted in varying amounts of usage data, however a number of trends were evident amongst most units. Activity points in each unit were substantially higher than Contribution and Communication points. This is because all actions that influence the participation awareness mechanism receive Activity points, while only some of them receive Contribution or Communication points (Table 3.6). Contribution and Communication points remained quite close throughout the usage period of most units. As evident in Appendix N, the most noticeable impact of applying limits to the participation awareness mechanism was the awarding of fewer Activity points during times of high activity. The overall trends and relationships between the different categories of points were not significantly altered by the application of limits to the participation awareness mechanism. This indicates that the limits were able to prevent the awarding of excessive points, while still maintaining the accuracy of the mechanism.

P2 and M5, which were different iterations of the same unit, were the only units in which Contribution and Communication points displayed a distinct offset, with Contribution remaining considerably higher than Communication at all times. Examination the usage data reveals that this was likely due to the nature and specifications of the group in this unit. In both iterations of the research, a substantially higher number of files, the primary action awarding Contribution points, were submitted by users in this unit. These files consisted of numerous revisions of sections of the project content and documentation that groups were tasked with producing, as well as a large number of weekly progress reports and minutes of meetings. Many file submissions, particularly progress reports and minutes, received little or no comments, resulting in a higher proportion of Contribution points than Communication points.

Multiple units demonstrated spikes in usage, typically occurring shortly before a piece of assessable group-based work was due. This was evident not only in the correlation between due dates and usage levels, but also in numerous open-ended responses to the post-usage questionnaire such as “The heaviest usage activity occurred about a week before the assignment was due” (Participant 18).

There was a one or two week lull in usage in some units in the latter half of the semester. Some open-ended responses such as “Later on the usage decreased as I had other more pressing assessments to attend to” (Participant 38) suggest that this may have been due to students focusing assignments in other units, which are often due at this time of semester. In all units, usage of GroupShare declined rapidly once the group-based work had been completed and submitted, even if continued group communication and work was encouraged. This was entirely expected, as GroupShare was designed and presented as a tool to assist in group-based collaborative work.

### ***5.3 Groups***

Across all units in both iterations, there were 53 active groups in GroupShare. While usage data was captured for all students, many failed to complete both questionnaires. In order to draw results from as complete sets of data as possible, groups in which 50% or more of the members did not provide a full data set were eliminated from group-based analysis. A total of 11 groups met the criteria for analysis. Each of these groups is examined in the following sub-sections, utilising all available data. Usage data was used to produce usage statistics and recreate participation awareness scores, while the summary values extrapolated from the pre and post-usage questionnaires, where available, serve to provide an overview of each student’s feedback. Open-ended responses have been cited where appropriate – the spelling and grammar of these responses has been left unchanged.

Each group overview contains a group of four tables. Group members who provided complete data sets have been labelled as Participants, consistent with the classification and numbering of participants in other chapters, while those who did not provide complete data sets have been labelled Students. The first table displays a

number of GroupShare usage statistics from core areas of the application. The second recreates each student’s participation awareness scores, as calculated and presented in the Complex Text presentation style (see Section 3.6.2) at the end of their usage period. To make the scores easier to comprehend and compare, values which are substantially lower or higher than the average score of the group have been indicated by a ‘(-)’ or a ‘(+)’ respectively. The below average symbol is applied to scores that are more than one standard deviation below the average points of the group, and the above average symbol is applied to scores that are more than one standard deviation above the average points of the group. The average and standard deviation of each category of participation awareness scores have been shown in the table header, labelled ‘Av’ and ‘StD’ respectively. Group members have been compared to the average of their group, rather than to the average of the whole unit, as the values concern participation within a group. A unit-based average would have little relevance or meaning to individual groups. The third and fourth tables reproduce the summary values from the pre and post-usage questionnaires, where available.

### 5.3.1 Group 1 Analysis

Table 5.4 – Group 1 (unit M2)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 46	51	15	33	3	26	9	253
Participant 48	37	2	2	0	0	0	239
Participant 58	83	16	38	4	66	11	343
Participant 63	91	6	16	0	38	1	30
Student 8	25	12	16	6	19	9	1

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 252.6 StD: 102.7	Communication Av: 239.6 StD: 117.3	Activity Av: 589.0 StD: 210.5	Overall Av: 1081.2 StD: 415.3
Participant 46	347	339	730	1416
Participant 48	82 (-)	134	347 (-)	563 (-)
Participant 58	367 (+)	419 (+)	906 (+)	1692 (+)
Participant 63	212	170	579	961
Student 8	255	136	383	774

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 46	High	Neutral	Moderate	Neutral
Participant 48	Moderate	Mildly Positive	Low	Neutral
Participant 58	High	Neutral	Low	Strongly Positive
Participant 63	High	Strongly Negative	Low	Neutral
Student 8	-	-	-	-



<b>D. Post-Usage questionnaire summary values</b>				
<b>ID</b>	<b>SV5. PA Accuracy</b>	<b>SV6. PA Impact</b>	<b>SV7. PA Affinity</b>	<b>SV8. Favourite Presentation Style</b>
Participant 46	Neutral	Mildly Positive	Mildly Positive	Complex Text
Participant 48	None	Neutral	Mildly Negative	Simple Graphics
Participant 58	Both	Mildly Positive	Mildly Positive	No Clear Favourite
Participant 63	Self Only	Neutral	Neutral	No Clear Favourite
Student 8	Both	Strongly Positive	Strongly Positive	No Clear Favourite

Group 1 (Table 5.4) was in unit M2 and contained five members, four of whom provided complete data sets. The usage statistics and participation awareness scores indicate that most members participated quite evenly. Most group members responded positively to the participation awareness mechanism. Participant 46 was one of four participants who identified the Complex Text presentation style as a clear favourite, stating “it reflected what i did very well” in the post-usage questionnaire.

Participant 58 received higher participation awareness scores than the rest of the group, with usage statistics to match. His summary values indicate that he was somewhat ambivalent to group work and had little prior experience with online group work. His response to the participation awareness mechanism was mildly positive – finding that it accurately represented the participation of both himself and the other members of his group.

In contrast to Participant 58, Participant 48 demonstrated the lowest usage of GroupShare and received the least participation awareness points. While she participated in the live chat, she did not utilise most other parts of GroupShare very much. Participant 48’s summary values indicate that she used the Internet less than her other group members, had a little prior experience with online group work, and was neutral towards the concept of participation awareness. She did not find the mechanism accurate and demonstrated a mildly negative affinity towards it in the post-usage questionnaire.

## 5.3.2 Group 2 Analysis

Table 5.5 – Group 2 (unit M2)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 31	153	21	93	3	4	0	72
Participant 49	99	6	57	3	0	0	26
Participant 60	61	3	25	5	0	0	46
Participant 61	56	21	59	2	0	0	54
Student 7	99	28	141	4	2	0	109

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 286.4 StD: 104.1	Communication Av: 272.0 StD: 109.5	Activity Av: 751.6 StD: 231.3	Overall Av: 1310.0 StD: 423.2
Participant 31	372	360	1018 (+)	1750 (+)
Participant 49	289	210	815	1314
Participant 60	91 (-)	154 (-)	418 (-)	663 (-)
Participant 61	302	195	552	1049
Student 7	378	441 (+)	955	1774 (+)

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 31	Low	Mildly Positive	Moderate	Mildly Positive
Participant 49	Low	Mildly Negative	Low	Strongly Positive
Participant 60	High	Neutral	Moderate	Mildly Negative
Participant 61	Moderate	Mildly Negative	Moderate	Mildly Positive
Student 7	Moderate	Mildly Positive	High	Mildly Positive

D. Post-Usage questionnaire summary values				
ID	SV5. PA Accuracy	SV6. PA Impact	SV7. PA Affinity	SV8. Favourite Presentation Style
Participant 31	None	Mildly Negative	Strongly Negative	Simple Graphics
Participant 49	Both	Strongly Positive	Strongly Positive	Simple Graphics
Participant 60	None	Mildly Positive	Mildly Positive	Simple Graphics
Participant 61	Both	Strongly Positive	Strongly Positive	No Clear Favourite
Student 7	-	-	-	-

Group 2 (Table 5.5) was in unit M2 and contained five members, four of whom provided complete data sets. The usage statistics and participation awareness scores indicate that while most members participated quite evenly, Participant 31, Participant 61 and Student 7 submitted the vast majority of files. Student 7 also used the message board and live chat features much more than other group members, as did Participant 31 to a lesser degree. The private group forum was barely used, receiving only six posts, and the rating feature was not used at all. Most group members responded positively to the participation awareness mechanism.

Participant 31, who demonstrated a level of participation marginally above the group average, disliked the participation awareness mechanism – the summary values

showing that he did not find it accurate, felt it had a negative impact, and had a strongly negative affinity towards it. His open-ended responses stated that while he felt some may find the participation awareness mechanism useful, he found it to be “rather pointless, since everyone already has an idea of how other members of the group are contributing”, and suggested the option to hide it.

Participants 49 and 61 both indicated a mild dislike of group work in the pre-usage questionnaire. Both of these participants responded very well to the participation awareness mechanism, finding it accurate for themselves and their group members, and feeling it had a strongly positive impact on their group. While Participant 60 responded positively to participation awareness, his open-ended responses in the post-usage questionnaire made it clear that he recognised the mechanisms inability to assess the quality of participation – “although it’ll never be completely accurate it gives you an idea of what is being done. .... Some people tend to just upload lots of files without substance.” This participant did not find the mechanism to be accurate, and received participation awareness scores below one standard deviation of the group average in all categories.

### 5.3.3 Group 3 Analysis

Table 5.6 – Group 3 (unit P1)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 6	19	6	5	0	0	0	4
Participant 9	28	5	6	1	0	0	0
Participant 13	51	9	9	1	0	0	0
Participant 16	76	8	28	5	1	0	19
Student 2	37	6	8	1	1	0	14

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 143.4 StD: 30.9	Communication Av: 62.0 StD: 32.6	Activity Av: 350.4 StD: 165.7	Overall Av: 555.8 StD: 227.4
Participant 6	133	38	236	407
Participant 9	118	31	202	351
Participant 13	136	54	374	564
Participant 16	204 (+)	123 (+)	661 (+)	988 (+)
Student 2	126	64	279	469

<b>C. Pre-Usage questionnaire summary values</b>				
<b>ID</b>	<b>SV1. Internet Usage</b>	<b>SV2. Group Work Affinity</b>	<b>SV3. Online Group Work Experience</b>	<b>SV4. PA Concept Affinity</b>
Participant 6	High	Neutral	High	Mildly Positive
Participant 9	Moderate	Mildly Positive	Moderate	Mildly Positive
Participant 13	High	Mildly Negative	Moderate	Mildly Positive
Participant 16	High	Neutral	High	Strongly Positive
Student 2	High	Mildly Negative	Moderate	Strongly Negative

<b>D. Post-Usage questionnaire summary values</b>				
<b>ID</b>	<b>SV5. PA Accuracy</b>	<b>SV6. PA Impact</b>	<b>SV7. PA Affinity</b>	<b>SV8. Favourite Presentation Style</b>
Participant 6	Both	Mildly Negative	Mildly Negative	Simple Graphics
Participant 9	Neutral	Mildly Positive	Mildly Positive	No Clear Favourite
Participant 13	Both	Mildly Positive	Mildly Positive	No Clear Favourite
Participant 16	None	Strongly Positive	Mildly Positive	No Clear Favourite
Student 2	-	-	-	-

Group 3 (Table 5.6) was in unit P1 and contained five members, four of whom provided complete data sets. A sixth student was registered in the group, but displayed no activity and did not participate in the group in any way. This student has been omitted from the group overview. The usage statistics and participation awareness scores indicate that while most members participated quite evenly, Participant 16 was more active and utilised the message board and comment features more than other group members. Many features of GroupShare received little or no usage by this group, with open-ended responses reporting that usage was abandoned after the completion of the group assignment in week five of semester. Most group members responded positively to the participation awareness mechanism.

Student 2 was negative towards the concept of a participation awareness mechanism, a stance explained by his open-ended responses in the pre-usage questionnaire - “At the end of the day I am interested in whether or not the work has been done. .... In my opinion the ability to track people contributions is only ever going to be useful if the project fails and people are looking for someone to blame.” Student 2 did not complete the post-usage questionnaire, making it impossible to determine his position after the usage period.

The rest of the group responded positively to the participation awareness mechanism, except for Participant 6, who despite finding it accurate, reported a mildly negative impact and affinity. His open-ended response to the mechanism states that “it was the watch dog; group participation is more than download, upload and view activity”, indicating some dissatisfaction with the metrics and their quantitative nature.

### 5.3.4 Group 4 Analysis

Table 5.7 – Group 4 (unit M2)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 28	248	19	0	43	31	6	1011
Participant 47	347	27	0	28	32	3	1401
Participant 54	191	19	0	27	34	9	700
Student 11	97	13	0	6	10	1	706
Student 12	60	9	0	7	14	0	283

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 631.6 StD: 181.3	Communication Av: 787.6 StD: 298.6	Activity Av: 2014.4 StD: 809.9	Overall Av: 3433.6 StD: 1277.9
Participant 28	769	1042	2669	4480
Participant 47	754	1129 (+)	2892 (+)	4775 (+)
Participant 54	813 (+)	871	2416	4100
Student 11	422 (-)	564	1206	2192
Student 12	400 (-)	332 (-)	889 (-)	1621 (-)

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 28	High	Mildly Positive	Moderate	Mildly Positive
Participant 47	High	Strongly Positive	Low	Mildly Positive
Participant 54	Moderate	Mildly Negative	Moderate	Strongly Positive
Student 11	-	-	-	-
Student 12	-	-	-	-

D. Post-Usage questionnaire summary values				
ID	SV5. PA Accuracy	SV6. PA Impact	SV7. PA Affinity	SV8. Favourite Presentation Style
Participant 28	Both	Strongly Positive	Strongly Positive	No Clear Favourite
Participant 47	Self Only	Mildly Positive	Neutral	No Clear Favourite
Participant 54	None	Mildly Positive	Neutral	No Clear Favourite
Student 11	-	-	-	-
Student 12	-	-	-	-

Group 4 (Table 5.7) was in unit M2 and contained five members, three of whom provided complete data sets. The usage statistics and participation awareness scores indicate that while most members participated quite evenly, Students 11 and 12 were not as active as the other group members. Most features of GroupShare were utilised,

although not a single message was posted to the message board. Compared to other groups, this group demonstrated a high amount of GroupShare usage. All members of this group exhibited similar demographics, being males between 21 and 30 years.

Of the three group members who completed the post-usage questionnaire, Participant 28 was strongly positive towards the participation awareness mechanism and its impact, stating that he “regularly viewed each diagram and it helped me understand how the others were going and how i would rate each members performance.” Participants 47 and 54 had a neutral affinity to the mechanism, but felt it had a mildly positive impact. Participant 47’s open-ended responses to the post-usage questionnaire revealed that he felt commenting on files was awarded too highly by the mechanism, as he believed that commenting did not necessarily entail meaningful contribution. This was also recognised by Participant 54, who in addition mentioned that the inability of the participation awareness mechanism to capture face-to-face participation as an issue.

### 5.3.5 Group 5 Analysis

Table 5.8 – Group 5 (unit P1)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 2	111	5	24	10	4	2	285
Participant 12	123	9	41	17	1	0	726
Participant 14	30	10	9	15	1	0	183
Student 4	51	12	25	10	1	0	364

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 211.8 StD: 35.3	Communication Av: 311.0 StD: 76.3	Activity Av: 773.8 StD: 250.5	Overall Av: 1296.5 StD: 353.0
Participant 2	193	297	879	1369
Participant 12	264 (+)	412 (+)	1100 (+)	1776 (+)
Participant 14	169 (-)	200 (-)	416 (-)	785 (-)
Student 4	221	335	700	1256

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 2	High	Mildly Negative	Moderate	Mildly Positive
Participant 12	High	Mildly Negative	Moderate	Mildly Positive
Participant 14	Moderate	Strongly Negative	Moderate	Mildly Negative
Student 4	High	Neutral	High	Mildly Positive

<b>D. Post-Usage questionnaire summary values</b>				
<b>ID</b>	<b>SV5. PA Accuracy</b>	<b>SV6. PA Impact</b>	<b>SV7. PA Affinity</b>	<b>SV8. Favourite Presentation Style</b>
Participant 2	Both	Neutral	Mildly Positive	Complex Graphics
Participant 12	Self Only	Mildly Positive	Mildly Positive	Simple Graphics
Participant 14	None	Mildly Positive	Strongly Positive	No Clear Favourite
Student 4	-	-	-	-

Group 5 (Table 5.8) was in unit P1 and contained four members, three of whom provided complete data sets. A fifth student was registered in the group, but displayed no activity and did not participate in the group in any way. This student has been omitted from the group overview. The usage statistics and participation awareness scores indicate that all members participated quite evenly. Participant 12 received participation awareness scores above one standard deviation of the group average in all categories, while Participation 14 received scores below one standard deviation of the group average in all categories.

The private group forum was barely used, however the message board, comments and live chat all received regular usage. Only two ratings were given throughout the group's usage period, explained by Participant 12 in the post-usage questionnaire – "Personally don't think the rating system is a good idea in small groups, maybe large groups. Our group did not use it, as we felt face to face feedback/discussion on each others work was more appropriate." All members of the group were enrolled in on campus study, and had face-to-face contact on a frequent basis (more than once per week).

All members of this group had a moderate or high level of prior experience with online group work, and all but one had a negative affinity to group work. Pre-usage questionnaire responses indicate that this was largely due to the reliance on others and having experienced unequal participation in prior group work. While not all group members found the participation awareness mechanism to be entirely accurate, the mechanism received a positive response.

Participant 14's participation awareness score was somewhat lower than the rest of the group's. Further examination of the usage data and open-ended responses to the post-usage questionnaire revealed that this was due to him being unable to find time

to access GroupShare for part of the usage period, evidenced in his relatively low number of logins. While the infrequency of his activity in GroupShare led to lower participation awareness scores, he submitted 10 files to the group, representing approximately 28% of the total files submitted in a group of four members. This and other usage statistics indicate that he was an active and equal participant in the group despite his limited access, explaining and justifying the fact that he found the participation awareness mechanism to be inaccurate.

### 5.3.6 Group 6 Analysis

Table 5.9 – Group 6 (unit M3)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 29	69	30	41	6	2	0	45
Participant 50	15	2	3	3	6	0	1
Participant 51	75	30	30	12	5	0	1
Student 9	38	5	25	6	4	0	24
Student 13	44	6	26	5	7	0	21

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 237.4 StD: 100.5	Communication Av: 148.6 StD: 69.1	Activity Av: 489.2 StD: 158.6	Overall Av: 875.2 StD: 317.4
Participant 29	376 (+)	249 (+)	739 (+)	1364 (+)
Participant 50	163	36 (-)	282 (-)	481 (-)
Participant 51	341 (+)	179	578	1098
Student 9	175	142	468	785
Student 13	132 (-)	137	379	648

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 29	Low	Mildly Negative	Moderate	Neutral
Participant 50	Low	Mildly Positive	Low	Neutral
Participant 51	Moderate	Mildly Negative	Moderate	Neutral
Student 9	-	-	-	-
Student 13	-	-	-	-

D. Post-Usage questionnaire summary values				
ID	SV5. PA Accuracy	SV6. PA Impact	SV7. PA Affinity	SV8. Favourite Presentation Style
Participant 29	Both	Strongly Positive	Strongly Positive	Simple Graphics
Participant 50	None	Mildly Negative	Mildly Negative	Simple Graphics
Participant 51	None	Mildly Negative	Mildly Negative	Simple Graphics
Student 9	Others Only	Mildly Positive	Mildly Positive	Complex Graphics
Student 13	-	-	-	-

Group 6 (Table 5.9) was in unit M3 and contained five members, three of whom provided complete data sets. The usage statistics and participation awareness scores



show higher usage of GroupShare by participants 29 and 51, particularly noticeable in the number of files submitted. In an open-ended response in the post-usage questionnaire, Student 9 stated that one group member submitted content that was “totally unusable just to show that she was contributing.” Despite this being noticed, the rating feature was not utilised by any group member, which could have minimised the impact of such contributions on the participation awareness mechanism.

Participants 50 and 51 responded negatively to the participation awareness mechanism, explained in open-ended responses to the post-usage questionnaire. Participant 50 had trouble using GroupShare due to her unreliable and low-speed Internet connection, resulting in participation awareness scores that were lower than she felt she deserved. Participant 51 recognised that the mechanism was unable to capture work done outside of GroupShare and that it was not able to assess the quality of a contribution, and hence “found the PA feature a bit of a novelty and didn’t take it very seriously”. Participant 29, who demonstrated an above average level of usage, found the participation awareness mechanism to be accurate and responded very positively to it. The members of this group were all female, from a range of age groups.

### 5.3.7 Group 7 Analysis

Table 5.10 – Group 7 (unit P1)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 10	36	6	0	5	17	0	1
Participant 17	59	4	0	6	9	0	0
Participant 18	47	4	0	1	7	2	0
Student 3	119	5	0	6	12	3	2
Student 14	45	4	0	5	12	0	1

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 167.0 StD: 50.7	Communication Av: 51.4 StD: 16.0	Activity Av: 431.0 StD: 145.5	Overall Av: 649.4 StD: 209.2
Participant 10	170	60	400	630
Participant 17	125	39	336	500
Participant 18	116 (-)	27 (-)	298	441
Student 3	259 (+)	71 (+)	710 (+)	1040 (+)
Student 14	165	60	411	636

<b>C. Pre-Usage questionnaire summary values</b>				
<b>ID</b>	<b>SV1. Internet Usage</b>	<b>SV2. Group Work Affinity</b>	<b>SV3. Online Group Work Experience</b>	<b>SV4. PA Concept Affinity</b>
Participant 10	Low	Mildly Negative	Moderate	Mildly Positive
Participant 17	High	Mildly Negative	Moderate	Mildly Positive
Participant 18	High	Mildly Negative	Moderate	Mildly Positive
Student 3	High	Mildly Positive	High	Mildly Positive
Student 14	-	-	-	-

<b>D. Post-Usage questionnaire summary values</b>				
<b>ID</b>	<b>SV5. PA Accuracy</b>	<b>SV6. PA Impact</b>	<b>SV7. PA Affinity</b>	<b>SV8. Favourite Presentation Style</b>
Participant 10	Both	Mildly Positive	Mildly Positive	Complex Text
Participant 17	Both	Mildly Positive	Mildly Positive	Simple Graphics
Participant 18	Both	Mildly Negative	Mildly Positive	Simple Text
Student 3	-	-	-	-
Student 14	-	-	-	-

Group 7 (Table 5.10) was in unit P1 and contained five members, three of whom provided complete data sets. A sixth student was registered in the group, but displayed no activity and did not participate in the group in any way. This student has been omitted from the group overview. The usage statistics and participation awareness scores indicate that most members participated quite evenly, with Student 3 displaying higher usage in all categories of the participation awareness scores. The message board, rating and live chat features received little or no usage by this group. Like most groups in units P1 and M3, usage was largely discontinued after the completion of required group work in the first half of the semester.

Questionnaire responses from this group resulted in similar summary values for most members. Internet usage was typically high and included a moderate amount of online group work experience. Most members had a negative affinity towards group work, having experienced unequal participation in prior group work, and all members were positive towards the concept of participation awareness. While each member who completed the post-usage questionnaire favoured a different presentation style, each was considered accurate and the mechanism was found to have a positive impact by all except Participant 18. While Participant 18 did not provide open-ended responses that clarified this, his responses to questions in section three of the post-usage questionnaire suggest that although the feature helped him to understand his group members, he did not find that it encouraged him to be more active or work harder. Overall, the participation awareness mechanism was well received by this group.

### 5.3.8 Group 8 Analysis

Table 5.11 – Group 8 (unit P2)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 11	76	17	23	18	40	8	222
Participant 19	92	7	1	5	4	3	186
Participant 21	153	41	55	60	63	1	376
Student 1	106	15	23	1	35	2	125
Student 5	53	11	4	2	6	0	61
Student 15	39	7	2	0	0	0	57

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 462.5 StD: 271.5	Communication Av: 346.5 StD: 224.4	Activity Av: 1047.8 StD: 484.4	Overall Av: 1856.8 StD: 975.2
Participant 11	673	547	1511	2731
Participant 19	363	222	960	1545
Participant 21	931 (+)	727 (+)	1767 (+)	3425 (+)
Student 1	451	339	1081	1871
Student 5	238	143	610	991
Student 15	119 (-)	101 (-)	358 (-)	578 (-)

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 11	High	Mildly Positive	Moderate	Strongly Positive
Participant 19	High	Neutral	High	Mildly Positive
Participant 21	High	Strongly Negative	Moderate	Strongly Positive
Student 1	High	Mildly Positive	High	Mildly Positive
Student 5	High	Mildly Negative	High	Mildly Positive
Student 15	-	-	-	-

D. Post-Usage questionnaire summary values				
ID	SV5. PA Accuracy	SV6. PA Impact	SV7. PA Affinity	SV8. Favourite Presentation Style
Participant 11	Both	Mildly Positive	Strongly Positive	Complex Text
Participant 19	Both	Mildly Positive	Mildly Positive	No Clear Favourite
Participant 21	Both	Strongly Positive	Strongly Positive	Complex Graphics
Student 1	-	-	-	-
Student 5	-	-	-	-
Student 15	-	-	-	-

Group 8 (Table 5.11) was in unit P2 and contained six members, three of whom provided complete data sets. The usage statistics and participation awareness scores show quite a high degree of GroupShare usage by this group, involving all areas of the application. Akin to Group 4 (Section 5.3.4), which also displayed a high level of activity, the members of this group were all males between 21 and 30 years of age. Participant 21 and Student 15 received participation awareness scores above and below one standard deviation of the group average, respectively. The live chat feature was heavily used, although some group members desired a more sophisticated feature, listing it as a potential improvement to GroupShare.

The summary values for members of this group were, like those of Group 7, very similar. All members had a high level of Internet use and a moderate or high amount of experience with online group work. While the members' affinity towards group work varied, all were positive towards the concept of participation awareness, feeling that the increased awareness would allow groups to work more effectively and respond to a lack of participation earlier in a group work scenario.

All members who completed the post-usage questionnaire responded positively to the participation awareness mechanism, finding it accurate and feeling it had a positive impact. Participant 11 recognised that rating files and forum threads allowed the mechanism to modify scores based on quality rather than quantity, but was dismayed that not many group members regularly gave ratings – “the feature is useless if people don't use it”. Several members of the group enjoyed the trophies, feeling that they promoted competitiveness in the group which resulted in an increase of constructive activity.

### 5.3.9 Group 9 Analysis

Table 5.12 – Group 9 (unit P3)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 1	49	14	16	3	1	9	11
Participant 4	41	10	6	36	7	41	41
Participant 24	64	6	3	1	0	21	3
Student 6	54	8	27	8	4	2	16
Student 16	21	11	6	2	0	0	10
Student 17	11	12	8	5	4	5	0

B. Participation awareness scores (Complex Text style)								
ID	Contribution Av: 225.5 StD: 63.5		Communication Av: 118.8 StD: 55.5		Activity Av: 454.7 StD: 209.4		Overall Av: 799.0 StD: 282.7	
Participant 1	253		124		474		851	
Participant 4	299 (+)		226 (+)		520		1045	
Participant 24	291 (+)		74		832 (+)		1197 (+)	
Student 6	185		143		468		796	
Student 16	117 (-)		63 (-)		178 (-)		358 (-)	
Student 17	208		83		256		547	

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 1	High	Neutral	Moderate	Strongly Positive
Participant 4	High	Mildly Negative	Moderate	Mildly Positive
Participant 24	Moderate	Mildly Negative	Low	Neutral
Student 6	High	Neutral	High	Strongly Positive
Student 16	-	-	-	-
Student 17	-	-	-	-

D. Post-Usage questionnaire summary values				
ID	SV5. PA Accuracy	SV6. PA Impact	SV7. PA Affinity	SV8. Favourite Presentation Style
Participant 1	Both	Mildly Positive	Strongly Positive	Complex Graphics
Participant 4	Both	Mildly Positive	Mildly Positive	No Clear Favourite
Participant 24	None	Mildly Positive	Neutral	No Clear Favourite
Student 6	-	-	-	-
Student 16	-	-	-	-
Student 17	-	-	-	-

Group 9 (Table 5.12) was in unit P3 and contained six members, three of whom provided complete data sets. The usage statistics and participation awareness scores show that all members were active, and all areas of the system received some usage. The rating feature was heavily used, particularly by Participants 4 and 24, who received higher than average participation awareness scores in several categories. Both participants responded neutrally to question 44 of the post-usage questionnaire, which asked if they felt ratings should have a larger impact on the participation awareness mechanism.

Group members responded positively to the participation awareness mechanism, with Participant 4 stating, “it encouraged other members of my group to do more work.” Participant 24 did not find the mechanism accurate, but gave no other comment than “wasnt entirely accurate”.

### 5.3.10 Group 10 Analysis

Table 5.13 – Group 10 (unit M2)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 53	113	34	0	27	42	0	16
Participant 59	115	6	0	29	28	0	10
Student 18	55	11	0	7	11	0	3
Student 19	31	7	0	7	9	0	10

<b>B. Participation awareness scores (Complex Text style)</b>								
ID	Contribution		Communication		Activity		Overall	
	Av: 326.8	StD: 127.1	Av: 133.3	StD: 74.4	Av: 656.3	StD: 239.9	Av: 1116.3	StD: 431.8
Participant 53	542 (+)		253 (+)		984 (+)		1779 (+)	
Participant 59	293		138		779		1210	
Student 18	254		73		487		814	
Student 19	218		69		375 (-)		662 (-)	

<b>C. Pre-Usage questionnaire summary values</b>				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 53	High	Mildly Negative	Low	Mildly Positive
Participant 59	High	Neutral	Moderate	Mildly Positive
Student 18	-	-	-	-
Student 19	-	-	-	-

<b>D. Post-Usage questionnaire summary values</b>				
ID	SV5. PA Accuracy	SV6. PA Impact	SV7. PA Affinity	SV8. Favourite Presentation Style
Participant 53	Self Only	Mildly Positive	Neutral	No Clear Favourite
Participant 59	None	Mildly Positive	Neutral	Simple Graphics
Student 18	-	-	-	-
Student 19	-	-	-	-

Group 10 (Table 5.13) was in unit M2 and contained four members, two of whom provided complete data sets. The usage statistics and participation awareness scores indicate that most members participated quite evenly, with Participant 53 displaying above average usage in all categories of the participation awareness scores, and Student 19 exhibiting a marginally below average level of usage. The message board and rating features were not used at all by this group.

Both group members who provided a full data set had a neutral affinity to it and felt that it had a mildly positive impact, despite reporting inaccuracies. In open-ended responses to the post-usage questionnaire, Participant 53 mentioned that some group members had attempted to game the participation awareness mechanism by repeatedly logging into GroupShare and making irrelevant posts in the private group forum. There were no other open-ended responses of note.

### 5.3.11 Group 11 Analysis

Table 5.14 – Group 11 (unit M3)

A. GroupShare usage statistics							
ID	Logins	Shared File Submissions	Message Board Posts	Comments	Group Forum Posts	Ratings	Live Chat Messages
Participant 32	45	11	20	2	2	1	2
Participant 62	65	13	14	4	0	2	16
Student 20	8	1	0	1	1	0	0
Student 21	83	10	19	6	1	0	15

B. Participation awareness scores (Complex Text style)				
ID	Contribution Av: 153.8 StD: 66.5	Communication Av: 81.3 StD: 42.7	Activity Av: 402.5 StD: 193.4	Overall Av: 637.5 StD: 293.3
Participant 32	208	101	408	717
Participant 62	213	101	605 (+)	919
Student 20	48 (-)	8 (-)	90 (-)	146 (-)
Student 21	146	115	507	768

C. Pre-Usage questionnaire summary values				
ID	SV1. Internet Usage	SV2. Group Work Affinity	SV3. Online Group Work Experience	SV4. PA Concept Affinity
Participant 32	High	Mildly Positive	Moderate	Mildly Positive
Participant 62	High	Mildly Negative	Moderate	Mildly Positive
Student 20	-	-	-	-
Student 21	-	-	-	-

D. Post-Usage questionnaire summary values				
ID	SV5. PA Accuracy	SV6. PA Impact	SV7. PA Affinity	SV8. Favourite Presentation Style
Participant 32	Both	Mildly Positive	Mildly Positive	Simple Text
Participant 62	Neutral	Mildly Positive	Neutral	Simple Text
Student 20	-	-	-	-
Student 21	-	-	-	-

Group 11 (Table 5.14) was in unit M3 and contained four members, two of whom provided complete data sets. The usage statistics and participation awareness scores indicate that most members participated quite evenly, with Student 20 receiving participation awareness scores below one standard deviation of the group average in all categories. As a whole, this group displayed a low level of GroupShare usage. Several features of GroupShare were not heavily utilised, however group work was only required in the first half of semester in unit M3, and the group met face-to-face on a weekly basis.

The participation awareness mechanism received a mildly positive response, with both participants preferring the Simple Text presentation style. Open-ended responses by both participants did not reveal any new insights.

## ***5.4 Group Summary and Trends***

No strong trends were found in the group analysis. Group or individual responses to the participation awareness mechanism did not demonstrate any strong correlations with variables such as the group's usage of GroupShare, the demographics of their members, or the unit in which the group resided. Groups 5, 7 and 9 contained members who exhibited a primarily negative affinity towards group work, and responded positively towards the participation awareness mechanism. The opposite, a positive affinity towards group work and negative response towards the mechanism, was not evident in any of the groups examined. While such observations are encouraging in regards to the suitability and impact of the mechanism, they were not readily observable enough or supported by sufficient data to label as a trend or imply any causative effect.

Post-usage questionnaire summary values within most groups fall into approximately the same ratios of responses as seen in the full set of participants. For example, summary values 6 and 7, concerning the impact of and affinity towards the participation awareness mechanism received positive responses of approximately 65% each, with approximately 25% being neutral. While the sample size per group is too small to reproduce this with such exactness, the proportions remain close to these figures in most groups.

The usage data gathered and presented for each group also allow for an examination of participation awareness response based on GroupShare feature usage. Different groups exhibited a variety of feature usage – for example, Groups 3 and 11 made little or no use of the forums, rating and live chat features, while Group 8 made use of all areas of GroupShare. The participation awareness mechanism made use of whatever metrics were available, and hence the mechanism in groups who did not utilise all features of the system was only able to utilise a subset of the potential metrics. No correlations were found between feature usage and participant response to the participation awareness mechanism or its accuracy, suggesting that the mechanism was able to function effectively regardless of which metrics eventuated in each group.



The lack of distinct trends in the group analysis indicates that participant perception of the participation awareness mechanism was not dependent on any group-related variables. Carroll, Neale, Isenhour, Rosson and McCrickard (2003, pp. 614-620) utilised a framework to evaluate factors which were of importance to awareness, including “the situation, group composition, the task and the tools provided in support of the task” (p. 615). These factors were present in the groups analysed, which demonstrated various demographics, fields of study, types of group work, usage periods and amounts of usage. A lack of evident trends suggests that the participation awareness mechanism, as implemented in GroupShare, is of quite a generically applicable nature.

### ***5.5 Participant Profiles***

This section utilises summary values and usage data in order to define profiles of participants. The profiles are focused on aspects deemed most likely to influence how the participation awareness mechanism would be received by a participant, such as their affinity towards group work, prior experience with online group work, and usage of GroupShare. Criteria for these profiles were drawn from the literature, the author’s personal experiences, and a preliminary analysis of the data gathered in this research. Some of the profiles contrast each other, profiling positive and negative responses or high and low values. While such pairs of profiles are mutually exclusive, the profiles as a whole are not – a single participant may meet the criteria for multiple profiles.

The criteria of each profile is presented and explained, with matching participants listed. To provide an overview of how these participants responded to the participation awareness mechanism, summary values five to eight are then reproduced and discussed, along with any other data of note from the questionnaires or usage data. Open-ended questionnaire responses from matching participants are cited wherever relevant. Profiles will be examined primarily by comparing their response to the participation awareness mechanism to the response seen in the full set of participants, as detailed in Chapter 4. Summary values five to eight for the full set of participants are reproduced in Table 5.15, in order to streamline these comparisons. Below the number of responses falling into each category of the summary values is a

percentage illustrating the response's proportion of the full response set. In summary values 6 and 7, where Likert-type categories have been employed, percentages have been grouped as positive, neutral and negative, for consistency with prior chapters. The percentages of responses are displayed for each of the following profiles, with the difference from the full set of participants in Table 5.15 shown in parentheses. This allows the relative ratios of summary value responses to be compared with ease. The number of participants matching a profile must be taken into consideration, as this has a direct influence on the possible exactness of the response percentages.

Table 5.15 – Summary values 5-8 for all participants (N=63 for A-C, N=61 for D)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
13	2	7	7	34
20.6%	3.2%	11.1%	11.1%	54.0%

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	8	15	30	10
12.7%		23.8%	63.5%	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
2	5	15	26	15
11.1%		23.8%	65.1%	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
26	10	16	4	5
42.6%	16.4%	26.2%	6.6%	8.2%

As each profile represents a subset of the full set of participants, the ratios of responses to each summary value are utilised as an indicator of a deviation from the norm response within a profile. Hence, profiles in which the ratios of summary value responses differ substantially from those seen in the full set of participants are seen to have responded differently to the mechanism.

### 5.5.1 Negative Group Work Newcomer

Table 5.16 – Criteria and matches for Negative Group Work Newcomer profile (N=8)

SV2 negative, SV3 low
<b>Negative Group Work Newcomer profile</b>
Participant 15, Participant 24, Participant 25, Participant 33, Participant 49, Participant 53, Participant 55, Participant 63.
<b>Total Matches: 8</b>

The Negative Group Work Newcomer profile matches participants who had a negative affinity towards group work, and a low level of experience with online group work. Eight participants match this profile (Table 5.16). Various reasons for disliking group work were given by these participants, although common reasons did surface. Participant 49 described “Organising times and places to meet to discuss things” and “Relying on others to complete adequate work” as his least liked aspects of group work. Shared workloads and multiple perspectives were cited as positive aspects of group work by members of this profile.

Table 5.17 – Summary values 5-8 for Negative Group Work Newcomer profile (N=8)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
2	0	1	2	3
25.0% (4.4%)	0.0% (-3.2%)	12.5% (1.4%)	25.0% (13.9%)	37.5% (-16.5%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	2	4	1
12.5% (-0.2%)		25% (1.2%)	62.5% (-1%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
1	0	3	2	2
12.5% (1.4%)		37.5% (13.7%)	50% (-15.1%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
7	0	1	0	0
87.5% (44.9%)	0.0% (-16.4%)	12.5% (-13.7%)	0.0% (-6.6%)	0.0% (-8.2%)

While no strong correlations are evident in the post-usage summary values, the majority participants in this profile responded positively to the participation awareness mechanism (Table 5.17). The ratios observed in the summary values of participants matching this profile are largely in accord with the ratios of the values amongst the full set of participants. This indicates that participants in the Negative Group Work Newcomer profile did not respond to the mechanism in a manner distinct from the norm. This is untrue for summary value 8 (Table 5.17, D), with only one participant displaying a favourite presentation style.

## 5.5.2 Positive Group Work Newcomer

Table 5.18 – Criteria and matches for Positive Group Work Newcomer profile (N=3)

SV2 positive, SV3 low
<b>Positive Group Work Newcomer profile</b>
Participant 47, Participant 48, Participant 50.
<b>Total Matches: 3</b>

The Positive Group Work Newcomer profile matches participants who had a positive affinity towards group work, and a low level of experience with online group work. Only three participants match this profile (Table 5.18). All of these participants mentioned sharing a workload and having multiple perspectives and people to brainstorm ideas with as aspects of group work that they liked.

Table 5.19 – Summary values 5-8 for Positive Group Work Newcomer profile (N=3)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
2	0	0	1	0
66.7% (46.1%)	0.0% (-3.2%)	0.0% (-11.1%)	33.3% (22.2%)	0.0% (-54.0%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	1	1	0
33.3% (20.6%)		33.3% (9.5%)	33.3% (-30.2%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	2	1	0	0
66.7% (55.6%)		33.3% (9.5%)	0% (-65.1%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
1	0	2	0	0
33.3% (-9.3%)	0.0% (-16.4%)	66.7% (40.5%)	0.0% (-6.6%)	0.0% (-8.2%)

The small number of participants matching this profile makes any meaningful extrapolation unfeasible. While the overall response to the participation awareness mechanism from participants matching this profile seems to be more negative than the response from the full set of participants (Table 5.19), the sample size is not large enough for a reliable trend to be established. The author theorises that a higher proportion of negative responses may be attributable to this profile's lack of experience with online group work, and hence a limited amount of exposure to the awareness issues that the participation awareness mechanism seeks to address.

### 5.5.3 Negative Group Work Veteran

Table 5.20 – Criteria and matches for Negative Group Work Veteran profile (N=23)

SV2 negative, SV3 moderate or high
<b>Negative Group Work Veteran profile</b>
Participant 2, Participant 4, Participant 10, Participant 12, Participant 13, Participant 14, Participant 17, Participant 18, Participant 21, Participant 26, Participant 29, Participant 34, Participant 35, Participant 37, Participant 38, Participant 40, Participant 41, Participant 42, Participant 43, Participant 51, Participant 54, Participant 61, Participant 62.
<b>Total Matches: 23</b>

The Negative Group Work Veteran profile matches participants who had a negative affinity towards group work, and a moderate or high level of experience with online group work. A total of 23 participants match this profile (Table 5.20). The negative aspects of group work cited by these participants were representative of those mentioned by the participants as a whole, with unequal or poor quality participation, reliance on others and communication problems being core concerns. Participant 54 stated the common concerns well – “Group members not pulling their weight. Having work done of a poor quality. The stress of not knowing whether a group member has done the work.”

Table 5.21 – Summary values 5-8 for Negative Group Work Veteran profile (N=23)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
4	0	2	1	16
17.4% (-3.2%)	0.0% (-3.2%)	8.7% (-2.4%)	4.3% (-6.8%)	69.6% (15.6%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	3	5	10	5
13.0% (0.3%)		21.7% (-2.1%)	65.2% (1.7%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	2	3	11	7
8.7% (-2.4%)		13.0% (-10.8%)	78.3% (13.2%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
7	6	7	1	2
30.4% (-12.2%)	26.1% (9.7%)	30.4% (4.2%)	4.3% (-2.3%)	8.7% (0.5%)

Overall, participants in the Negative Group Work Veteran profile responded positively to the participation awareness mechanism (Table 5.21). The summary values of this profile displayed a slightly higher ratio of positive responses to the mechanism and its

accuracy than evident amongst the full set of participants. Open-ended responses from the post-usage questionnaire such as “it encouraged other members of my group to do more work” (Participant 4) and “can see what others have been upto, if they have posted anything or downloaded/viewed documents” (Participant 37) indicate that the participation awareness mechanism succeeded in addressing some of the core concerns held by Negative Group Work Veterans. Such a response from this profile strengthens the theory by which the author justified the more negative response amongst Positive Group Work Newcomers (Section 5.5.2).

### 5.5.4 Positive Group Work Veteran

Table 5.22 – Criteria and matches for Positive Group Work Veteran profile (N=11)

SV2 positive, SV3 moderate or high
<b>Positive Group Work Veteran profile</b>
Participant 3, Participant 8, Participant 9, Participant 11, Participant 20, Participant 23, Participant 28, Participant 31, Participant 32, Participant 36, Participant 44.
<b>Total Matches: 11</b>

The Positive Group Work Veteran profile matches participants who had a positive affinity towards group work, and a moderate or high level of experience with online group work. In total, 11 participants match this profile (Table 5.22). Perhaps indicative of their experience, participants matching this profile frequently stated ‘deeper’ positive elements of group work in open-ended responses in the pre-usage questionnaire. While many participants focused primarily on the shared workload, Positive Group Work Veterans emphasised the benefits of having a wider range of perspectives, backgrounds, skills and knowledge, and the ability to strengthen interpersonal and communication skills needed for group work in the workplace.

Table 5.23 – Summary values 5-8 for Positive Group Work Veteran profile (N=11)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
1	1	1	0	8
9.1% (-11.5%)	9.1% (5.9%)	9.1% (-2.0%)	0.0% (-11.1%)	72.7% (18.7%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	2	1	5	3
18.2% (5.5%)		9.1% (-14.7%)	72.7% (9.2%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
1	0	1	4	5
9.1% (-2%)		9.1% (-14.7%)	81.8% (16.7%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
4	2	3	1	1
36.4% (-6.2%)	18.2% (1.8%)	27.3% (1.1%)	9.1% (2.5%)	9.1% (0.9%)

Most participants in the Positive Group Work Veteran profile responded positively to the participation awareness mechanism (Table 5.23). The summary values of this profile displayed a slightly higher ratio of positive responses to the mechanism and its accuracy than evident amongst the full set of participants. This was most noticeable in the higher proportion of ‘Both’ responses to summary value 5 (Table 5.23, A) and ‘Strongly Positive’ responses to summary values 6 and 7 (Table 5.23, B and C). Open-ended responses such as “It is good evidence to show who isn't contributing their fair share” (Participant 8) and “The ability to judge each members participation” (Participant 11) reflect the reports of the mechanism’s accuracy. Participant 44 found the participation awareness mechanism helped in coordinating and managing his group:

The Participation Awareness and Recent Activity features of GroupShare were extremely useful in seeing who was checking the website for any updates. On many occasions I noticed that at least one person had not checked GroupShare for several days and work was pending their approval or submission. In lieu of this, I sent an email asking them to check GroupShare. These features aided greatly, as without them, I would not have known who was actively keeping up to date and participating in the team.

Numerous participants in this profile provided open-ended responses in the post-usage questionnaire praising the participation awareness mechanism. Participant 28 appreciated having multiple presentation styles, stating “I regularly viewed each diagram and it helped me understand how the others were going and how i would rate each members performance.”

Higher ratios of positive responses to the participation awareness mechanism amongst both profiles concerning participants with high levels of experience in group work is encouraging. While the aim of the research is not to evaluate the impact of the

mechanism, a positive response from the group of participants with the most relevant experience suggests that the design of the mechanism in its current implementation was appropriate.

### 5.5.5 Low Online Experience

Table 5.24 – Criteria and matches for Low Online Experience profile (N=2)

SV1 low, SV3 low
<b>Low Online Experience profile</b>
Participant 49, Participant 50.
<b>Total Matches: 2</b>

The Low Online Experience profile matches participants who had both a low level of Internet usage, and a low level of experience with online group work. Only two participants match this profile (Table 5.24), a number that is not surprising given the prevalence of the Internet in the everyday lives of the sample demographic.

Table 5.25 – Summary values 5-8 for Low Online Experience profile (N=2)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
1	0	0	0	1
50.0% (29.4%)	0.0% (-3.2%)	0.0% (-11.1%)	0.0% (-11.1%)	50.0% (-4%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	0	0	1
50.0% (37.3%)		0.0% (-23.8%)	50.0% (-13.5%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	0	0	1
50.0% (38.9%)		0.0% (-23.8%)	50.0% (-15.1%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
0	0	2	0	0
0.0% (-42.6%)	0.0% (-16.4%)	100.0% (73.8%)	0.0% (-6.6%)	0.0% (-8.2%)

The sample size is much too small to identify any trends or correlations within this profile, particularly as the two participants responded in opposite ways to the participation awareness mechanism (Table 5.25). As mentioned in Section 5.3.6, Participant 50's negative response to the mechanism was due to her unreliable and low-speed Internet connection, which made GroupShare difficult for her to use. While



GroupShare is designed to minimise bandwidth requirements, a number of minor changes were implemented in response to Participant 50’s feedback. One of these, an increased time limit to transfer data when submitting a document, directly addresses an open-ended response by this participant – “I found it frustrating that my slow internet speed prevented me from uploading documents”.

### 5.5.6 Light GroupShare User

Table 5.26 – Criteria and matches for Light GroupShare User profile (N=15)

15 lowest ‘Overall’ Complex Text participation awareness scores
<b>Light GroupShare User profile</b>
Participant 6, Participant 7, Participant 9, Participant 10, Participant 13, Participant 17, Participant 18, Participant 20, Participant 25, Participant 26, Participant 36, Participant 44, Participant 48, Participant 50, Participant 60.
<b>Total Matches: 15</b>

The Light GroupShare User profile matches participants with the 15 lowest Overall participation awareness scores, as calculated by the Complex Text presentation style (Table 5.26). The lowest 15 Overall scores ranged between 221 and 689, with the average value amongst all participants being 1282. A low participation awareness score does not imply that a participant did little work, as it does not take into account the context of the group, unit, or usage period. For example, in units where group work was only required for part of the semester, a relatively low participation score is entirely appropriate. This profile concerns only the amount of exposure to and usage of GroupShare and the participation awareness mechanism.

Table 5.27 – Summary values 5-8 for Light GroupShare User profile (N=15)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
4	0	1	0	10
26.7% (6.1%)	0.0% (-3.2%)	6.7% (-4.4%)	0.0% (-11.1%)	66.7% (12.7%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	4	2	8	1
26.7% (14.0%)		13.3% (-10.5%)	60.0% (-3.5%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	4	1	9	1
26.7% (15.6%)		6.7% (-17.1%)	66.7% (1.6%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
5	2	7	1	0
33.3% (-9.3%)	13.3% (-3.1%)	46.7% (20.5%)	6.7% (0.1%)	0% (-8.2%)

While overall, participants in the Light GroupShare Usage profile responded similarly to participants as a whole, a few minor deviations are apparent (Table 5.27). The summary values regarding the impact of and affinity towards the participation awareness mechanism (Table 5.27, B and C) received a higher proportion of negative responses within this profile. The ratio of positive responses remained largely the same as those in the full set of participants, with the increased negative response coming from a decrease in neutral responses. Open-ended responses from participants reveal the primary reasons for this to be an increase in competition and inane activity in the group in order to achieve the highest score – indicating that some of these participants felt that the mechanism inspired non-constructive activity. It is likely that this is more of an issue amongst participants and groups with a low level of GroupShare usage, as they are not likely to have encountered the limits applied to the participation awareness metrics, and the impact of individual actions can be seen more readily when there are a smaller number of total actions. Despite this, there were a slightly higher proportion of participants in this profile who found the mechanism to be accurate for both themselves and other group members.

Participants in this profile also demonstrated a higher preference for the Simple Graphics presentation style (Table 5.27, D). The response to question 32 of the post-usage questionnaire (Table 4.92) indicate that this style was effective at providing information at-a-glance – an attribute of high importance to participants with low exposure to GroupShare and the participation awareness mechanism. This is supported by an open-ended comment of “I liked the pie charts, although it'll never be completely accurate it gives you an idea of what is being done” (Participant 60).

## 5.5.7 Heavy GroupShare User

Table 5.28 – Criteria and matches for Heavy GroupShare User profile (N=15)

15 highest 'Overall' Complex Text participation awareness scores
<b>Heavy GroupShare User profile</b>
Participant 3, Participant 8, Participant 11, Participant 12, Participant 15, Participant 19, Participant 21, Participant 22, Participant 28, Participant 31, Participant 39, Participant 47, Participant 53, Participant 54, Participant 58.
<b>Total Matches: 15</b>

The Heavy GroupShare User profile matches participants with the 15 highest Overall participation awareness scores, as calculated by the Complex Text presentation style (Table 5.28). The highest 15 Overall scores ranged between 1529 and 4775, with the average value amongst all participants being 1282. As with the previous profile, this profile concerns only the amount of exposure to and usage of GroupShare and the participation awareness mechanism.

Table 5.29 – Summary values 5-8 for Heavy GroupShare User profile (N=15 for A-C, N=14 for D)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
2	2	1	3	7
13.3% (-7.3%)	13.3% (10.1%)	6.7% (-4.4%)	20.0% (8.9%)	46.7% (-7.3%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	3	8	3
6.7% (-6.0%)		20.0% (-3.8%)	73.3% (9.8%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
1	0	4	6	4
6.7% (-4.4%)		26.7% (2.9%)	66.7% (1.6%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
8	0	2	1	3
57.1% (14.5%)	0.0% (-16.4%)	14.3% (-11.9%)	7.1% (0.5%)	21.4% (13.2%)

Most participants in the Heavy GroupShare User profile responded positively to the participation awareness mechanism, with the ratios of most summary value responses being largely in line with those of the full set of participants (Table 5.29). Participant 31 was mildly negative towards the mechanism, strongly negative towards its impact, and did not find it accurate. As mentioned in the analysis of his group (Section 5.3.2), he felt that the mechanism was “rather pointless, since everyone already has an idea

of how other members of the group are contributing” (Participant 31). Summary value 6 (Table 5.29, B) received a higher proportion of positive responses amongst this profile. Open-ended responses from these participants suggest that they were members of active and largely successful groups who made heavy use of GroupShare and appreciated the information the participation awareness mechanism provided.

Responses to summary value 8 (Table 5.29, D) total 14 rather than 15, as one participant did not correctly complete the ranking questions required to generate the value. This summary value demonstrates different response ratios, with fewer participants in this profile preferring the Simple Text presentation style, and more preferring the Complex Graphics style. The author speculates that participants who used GroupShare heavily appreciated the sophisticated and chronological nature of the Complex Graphics style. In open-ended post-usage questionnaire responses, several participants in this profile stated that they appreciated having multiple presentation styles available.

### 5.5.8 Low GroupShare Contributor

Table 5.30 – Criteria and matches for Low GroupShare Contributor profile (N=15)

15 lowest ‘Contribution / Overall’ Complex Text participation awareness scores
<b>Low GroupShare Contributor profile</b>
Participant 2, Participant 12, Participant 23, Participant 26, Participant 27, Participant 28, Participant 38, Participant 39, Participant 40, Participant 42, Participant 45, Participant 47, Participant 48, Participant 52, Participant 60.
<b>Total Matches: 15</b>

The Low GroupShare Contributor profile matches participants with the 15 lowest Contribution scores relative to their Overall participation awareness scores (Table 5.30). This profile aims to examine participants who contributed the least, relative to their overall participation in GroupShare – according to the participation awareness model. This is calculated by dividing the Contribution score by the Overall score, producing a number between zero and one. The average value of this number amongst the full set of participants was 0.24, indicating that an average of 24% of a participant’s Overall score was made up of their Contribution score. The highest value meeting the criteria for this profile is 0.19, with the lowest being 0.11. Participants in

this profile demonstrated a wide range of GroupShare usage levels – no correlation was found between usage and contribution rate.

Table 5.31 – Summary values 5-8 for Low GroupShare Contributor profile (N=15 for A-C, N=13 for D)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
3	0	2	4	6
20.0% (-0.6%)	0.0% (-3.2%)	13.3% (2.2%)	26.7% (15.6%)	40.0% (-14.0%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	8	5	1
6.7% (-6.0%)		53.3% (29.5%)	40.0% (-23.5%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	2	6	5	2
13.3% (2.2%)		40.0% (16.2%)	46.7% (-18.4%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
3	4	5	0	1
23.1% (-19.5%)	30.8% (14.4%)	38.5% (12.3%)	0.0% (-6.6%)	7.7% (-0.5%)

Overall, participants in the Low GroupShare Contributor profile responded positively to the participation awareness mechanism (Table 5.31). Summary values 6 and 7 (Table 5.31, B and C) received smaller proportions of positive responses and larger proportions of neutral responses in this profile – the negative responses remained proportional to those seen in the full set of participants. An examination of the open-ended responses reveals that several of the participants in this profile recognised the mechanism’s inability to assess the quality of contributions or recognise activity outside of GroupShare, resulting in potential misrepresentation or inaccuracy. This can be observed in summary value 5 (Table 5.31, A) of this profile, which shows a decrease in the proportion of ‘Both’. One participant in this profile simply stated “people like me are lazy....and the PA makes sure you work...” (Participant 23). Several members of this profile were online students, who are examined in Section 5.5.10.

Responses to summary value 8 (Table 5.31, D) total 13 rather than 15, as two participants did not correctly complete the ranking questions required to generate the value. This profile exhibited a higher preference for the simple presentation styles.

## 5.5.9 High GroupShare Contributor

Table 5.32 – Criteria and matches for High GroupShare Contributor profile (N=15)

15 highest 'Contribution / Overall' Complex Text participation awareness scores
<b>High GroupShare Contributor profile</b>
Participant 1, Participant 3, Participant 5, Participant 6, Participant 9, Participant 20, Participant 32, Participant 34, Participant 35, Participant 50, Participant 51, Participant 53, Participant 56, Participant 57, Participant 61.
<b>Total Matches: 15</b>

The High GroupShare Contributor profile matches participants with the 15 highest Contribution scores relative to their Overall participation awareness scores (Table 5.32), calculated in the same way as for the Low GroupShare Contributor profile (Section 5.5.8). This profile aims to examine participants who contributed the most, relative to their overall participation in GroupShare – according to the participation awareness model. The lowest value meeting the criteria for this profile is 0.29, with the highest being 0.40. The average value of this number amongst the full set of participants was 0.24. Most participants meeting the criteria for this profile had lower than average overall GroupShare usage levels. As Activity and communication points are awarded for a greater range of common actions, this is to be expected.

Table 5.33 – Summary values 5-8 for High GroupShare Contributor profile (N=15)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
3	0	1	2	9
20.0% (-0.6%)	0.0% (-3.2%)	6.7% (-4.4%)	13.3% (2.2%)	60.0% (6%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	4	2	6	3
26.7% (14.0%)		13.3% (-10.5%)	60.0% (-3.5%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	3	3	4	5
20.0% (8.9%)		20.0% (-3.8%)	60.0% (-5.1%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
6	2	5	0	2
40.0% (-2.6%)	13.3% (-3.1%)	33.3% (7.1%)	0.0% (-6.6%)	13.3% (5.1%)

Most participants in the Low GroupShare Contributor profile responded positively to the participation awareness mechanism (Table 5.33). Summary values 6 and 7 (Table 5.33, B and C) received a slightly higher proportion of negative responses, compared to

the full set of participants. Open-ended responses reveal numerous reasons for this – the potential for inaccuracy or misrepresentation due to the mechanism’s quantitative nature and its inability to recognise activity outside of GroupShare, and increased competition leading to unconstructive activity such as spam and noise. Overall, no reasons for a negative response specific to the criteria of the profile were identifiable. The author theorises that participants with a high ratio of Contribution points were in a greater position to notice inaccurate or misleading participation awareness information. The ratios of other summary value responses were in line with those of the full set of participants.

### 5.5.10 Online Student

Table 5.34 – Criteria and matches for Online Student profile (N=10)

Participant was enrolled to study their participating unit online
<b>Online Student profile</b>
Participant 27, Participant 30, Participant 37, Participant 38, Participant 39, Participant 40, Participant 42, Participant 43, Participant 45, Participant 52.
<b>Total Matches: 10</b>

The Online Student profile matches participants who were enrolled in their participating unit in an online mode. There were 10 such participants (Table 5.34). These students were typically placed into groups with each other by unit teaching staff, to avoid situations where some members of a group had face-to-face contact while others did not. Summary values from the pre-usage questionnaire reveal that these participants were all neutral or negative towards group work, and all had a moderate level of prior online group work experience.

Table 5.35 – Summary values 5-8 for Online Student profile (N=10 for A-C, N=8 for D)

<b>A. SV5. Participation Awareness Accuracy</b>				
None	Others Only	Neutral	Self Only	Both
0	0	3	2	5
0.0% (-20.6%)	0.0% (-3.2%)	30.0% (18.9%)	20.0% (8.9%)	50.0% (-4.0%)

<b>B. SV6. Participation Awareness Impact</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	6	2	1
10.0% (-2.7%)		60.0% (36.2%)	30.0% (-33.5%)	

<b>C. SV7. Participation Awareness Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	0	6	3	1
0.0% (-11.1%)		60.0% (36.2%)	40.0% (-25.1%)	

<b>D. SV8. Favourite Presentation Style</b>				
No Clear Favourite	Simple Text	Simple Graphics	Complex Text	Complex Graphics
1	5	1	1	0
12.5% (-30.1%)	62.5% (46.1%)	12.5% (-13.7%)	12.5% (5.9%)	0.0% (-8.2%)

Summary value response ratios in the Online Student profile differ slightly to those seen in the full set of participants, with summary values 5, 6 and 7 (Table 5.35, A, B and C) seeing a substantially greater proportion of neutral responses. Open-ended responses in the post-usage questionnaire indicate that participants appreciated having GroupShare available, and felt that it helped to resolve some of the difficulties with online study. While some of them made particular mention of the participation awareness mechanism, general feedback regarding GroupShare and its various awareness mechanisms was more common. Online students were contacted by e-mail rather than by a face-to-face introduction and discussion of GroupShare and the research aims, as detailed in Section 3.3.3, which may have resulted in less emphasis being placed on the participation awareness mechanism. The author feels that this may have been the cause for the increased neutral response amongst this profile, supported by several open-ended responses such as “If you mean the list of who logged in and how many times, I usually only glanced at it, every now and then” (Participant 52).

Responses to summary value 8 (Table 5.35, D) total 8 rather than 10, as two participants did not correctly complete the ranking questions required to generate the value. Most members of the Online Student profile preferred the Simple Text presentation style – as this was the default style, such a response further enforces the theory that less attention was paid to the mechanism by members of this profile.

### **5.5.11 Demographic Profiles**

A number of profiles were created based on the demographic data (Appendix M) collected via consent forms completed by participants. Profiles for male and female participants did not reveal any trend, with summary value response ratios remaining



consistent with the full set of participants. A profile of participants with a non-Australian nationality resulted in some slightly different ratios. However, as only seven of 63 participants were of a non-Australian nationality and each of these nationalities was unique, no meaningful insights could be drawn from this profile.

Profiles based on age resulted in two points of interest. Participants between 21 and 30 years old responded more positively to the participation awareness mechanism than other age groups. There is insufficient data to speculate as to why this is. Participants above 30 years of age, of which there were 15, responded more neutrally to the participation awareness mechanism. Further examination of the demographic data revealed that this is likely due to the fact that the majority of these participants were online students, whose neutral response was discussed in the Online Student profile (Section 5.5.10). The influence of the online students was also seen in demographic profiles based on unit, with unit M3 exhibiting a higher proportion of neutral responses. No other trends or distinctions were discovered in demographic-based profiles.

### **5.5.12 Strongly Positive and Negative Participation Awareness Responses**

The final profile in this sub-section examines the data of participants who exhibited an overwhelmingly positive or overwhelmingly negative response to the participation awareness mechanism, in order to better understand such responses. Summary values 5, 6 and 7 are used to identify participants of interest, in accordance with Table 5.36. The criteria for strongly negative responses are more lenient than the criteria for strongly positive ones, as no participants were classified as strongly negative in both summary value 6 and 7.

Table 5.36 – Criteria and matches for strongly positive (N=9) and strongly negative (N=5) responses

SV5 both, SV6 strongly positive, SV7 strongly positive
<b>Strongly Positive Participation Awareness Response</b>
Participant 3, Participant 21, Participant 28, Participant 29, Participant 35, Participant 43, Participant 44, Participant 49, Participant 61.
<b>Total Matches: 9</b>
SV5 none, SV6 strongly or mildly negative, SV7 strongly or mildly negative
<b>Strongly Negative Participation Awareness Response</b>
Participant 31, Participant 33, Participant 50, Participant 51.
<b>Total Matches: 4</b>

In regards to summary value 8, the ratio of favourite presentation styles amongst positive participants was close to that of the full set of participants – with a slightly higher preference for the Complex Graphics style. Three out of four of the participants who responded negatively preferred the Simple Graphics presentation style. Both groups of participants exhibited varied responses in summary values 1 to 4. Of the nine participants who responded extremely positively to participation awareness, two thirds of them had a negative affinity towards group work and 78% of them had a moderate amount of online group work experience (Table 5.37, B and C). Similarly, 78% of these participants had a moderate or high level of Internet usage (Table 5.37, A). All but one of them had a positive affinity to the concept of participation awareness, with one participant having a neutral affinity towards it (Table 5.37, D).

Table 5.37 – Summary values 1-4 for strongly positive participation awareness response (N=9)

<b>A. SV1. Internet Usage</b>				
Low	Moderate	High		
2	2	5		
<b>B. SV2. Group Work Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
1	5	0	3	0
<b>C. SV3. Online Group Work Experience</b>				
Low	Moderate	High		
1	7	1		
<b>D. SV4. PA Concept Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	0	1	4	4

Although the sample size of participants who responded negatively to participation awareness was smaller, they were found to have lower levels of Internet usage and online group work experience (Table 5.38, A and C). They were divided in regards to

group work affinity and participation awareness concept affinity, with equal responses on either side of neutral (Table 5.37, B and D).

Table 5.38 – Summary values 1-4 for strongly negative participation awareness response (N=4)

<b>A. SV1. Internet Usage</b>				
Low		Moderate		High
2		1		1

<b>B. SV2. Group Work Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	2	0	2	0

<b>C. SV3. Online Group Work Experience</b>		
Low		High
2		0

<b>D. SV4. PA Concept Affinity</b>				
Strongly Negative	Mildly Negative	Neutral	Mildly Positive	Strongly Positive
0	1	2	1	0

Demographic data for both positive and negative response groups was varied, exhibiting a range of ages and genders in similar proportions to that seen in the full set of participants. Participants who responded positively to participation awareness exhibited higher levels of GroupShare usage than those who responded negatively, with average Overall scores in the Complex Text presentation style being 1846 for the positive group compared to 1176 for the negative group. The average Overall participation awareness score amongst the full set of participants was 1282. However, these values are of limited meaning as usage levels varied greatly between different units and groups – therefore, such averages are devoid of important context. To better illustrate participant usage levels in the context of their groups, the Overall Complex Text style scores were compared to the group average in a similar manner to the group analyses in Section 5.3. Participants who responded positively to the participation awareness mechanism had Overall participation scores an average of 36% higher than their group averages, while those who responded negatively had scores only 7.5% over their group averages. Although both groups of participants were above their group averages, indicating that strong positive and negative responses were formulated by active group members, those who responded positively to the mechanism were usually substantially more active than other group members.

An examination of open-ended responses to the post-usage questionnaire reveals a number of central themes amongst participants who responded positively to participation awareness, which echo the positive feedback of the participants as a whole. They appreciated having a greater awareness of group member activity (or inactivity), felt that the mechanism discouraged “slacking off” (Participants 3 and 35), and found that having access to multiple presentation styles was beneficial. Some participants in this group mentioned minor issues which undermined the mechanism’s accuracy, such as “Individuals submit and delete and re-submit documents, so they’re total usage is increased” (Participant 35). The open-ended responses, in combination with the other data examined, indicate that participants who responded the most positively to the participation awareness mechanism were highly active group members, who placed a large degree importance upon group member activity and participation – and having a thorough awareness of this.

Given the sample size of participants who responded negatively to the mechanism, no strong trends were observable in open-ended responses. Participant 31 stated a dislike of the mechanism, finding it pointless as he did not perceive a lack of awareness – a somewhat uncommon stance amongst participants, many of whom named a lack of awareness as a negative aspect of group work in the pre-usage questionnaire. In the pre-usage questionnaire, he stated that while a participation awareness mechanism may motivate underperforming group members, he felt it could also “generate resentment within the group for one another” – although no evidence was visible in post-usage data to indicate that this eventuated. Participant 33 found the mechanism to be “almost useless”, but gave no further explanation. His predicted impact of the mechanism in the pre-usage questionnaire was that it would have “No real impact other than trying to get a higher score for boasting rights.” This suggests that he too did not perceive a lack of awareness as a problem in his group work, or that he did not feel the participation awareness mechanism was capable of addressing such an issue. Participant 50’s negative response has been previously examined, and was due largely to a slow and unstable Internet connection which prevented her from accessing GroupShare often or effectively. Participant 51 found the mechanism to be a novelty, and noted that it did not take out-of-system work or the quality of contributions into account. Overall, the participants who responded negatively appear

to be apathetic towards the mechanism, rather than harbouring a distinct dislike of it. They found it to be useless or pointless, for reasons based on its limitations (such its inability to capture out-of-system activity or assess the quality of contributions) or simply due to not perceiving a need for the mechanism.

Examining the strongly positive and negative groups of participants helped to identify the specific working demographics to which the participation awareness mechanism appealed the most, and reasons as to why it did not appeal to a small proportion of users. While most participants who were highly active in their groups responded positively towards the participation awareness mechanism, there is no particular evidence to suggest, either within this profile or amongst the full set of participants, that participants who were seen to be 'underperformers' responded more negatively to the mechanism than others.

### ***5.6 Participant Profile Summary and Trends***

Similar to the group-based analysis, examination of numerous participant profiles did not reveal a dramatically disparate response to the participation awareness mechanism from any particular group. While the small sample size of some profiles limited their usability, the large majority of profiles with a substantial number of matches demonstrated summary value response ratios that were consistent with those of the full set of participants.

Online students, almost all of whom were female students over 30 years of age enrolled in unit M3, responded more neutrally to the participation awareness mechanism than other participants. As discussed in Section 5.5.10, the author suspects that this is due to less emphasis being placed on the aims and focus of the research when it was introduced to these participants via e-mail.

The lack of trends in participant profiles further supports the suggestion that the participation awareness mechanism, as implemented in GroupShare, is of a generically applicable nature. The analyses presented in this chapter demonstrates that while varying periods, types and amounts of usage were evident, the response to participation awareness was largely consistent throughout all units of analysis.

## **Chapter 6 – Examination of Qualitative Data**

As detailed in Chapter 3, the research captured both quantitative and qualitative data. This chapter examines the qualitative elements of the collected data. This includes responses to open-ended questions in the otherwise quantitative questionnaires, student and staff interviews, and the reflective pieces completed by students in units P1 and M3.

### ***6.1 Post-Usage Questionnaire and Reflective Pieces***

The post-usage questionnaire contained numerous open-ended questions, some of which were required and some of which were optional. While several participant responses to these questions have already been cited in previous chapters within appropriate contexts, many others have not yet been examined.

Students in units P1 and M3, which were different instances of the same unit, were required to complete a reflective piece at the end of the semester as part of the unit. In this piece, students were asked to reflect on their experiences in the unit, with particular regards to working as a group and working in a group-work environment such as GroupShare. An anonymised version of the reflective pieces was provided to the author by the staff member teaching the units as a supplementary data source. Due to their anonymity, citing reflective pieces throughout other chapters is of limited value, as the context of questionnaire responses and usage data are lost. As all students in the units were required to submit a reflective piece, all citations from them in this chapter have been attributed to 'Anonymous Student', since it is not possible to verify that the piece was written by one of the 63 participants who provided a full set of data. The reflective pieces were grouped by the instance of the unit and groups of online students were labelled – these details have been included in citations.

The following sub-sections utilise open-ended responses from the post-usage questionnaire and the reflective pieces to examine the response to GroupShare and the participation awareness mechanism. While an evaluation of GroupShare itself is not a focus or goal of the research, feedback concerning it has been included to further

establish its role as a suitable groupware platform with which to investigate participation awareness. In addition, much of the feedback concerned GroupShare as a whole; hence reproducing some of these comments better represents the range of feedback that was received. As in previous chapters, the original spelling and grammar of citations has been preserved.

### **6.1.1 GroupShare Feedback**

Correlating with the findings of section 2 of the post-usage questionnaire (Section 4.4.2), GroupShare itself received much positive feedback. Various aspects of GroupShare were praised, with some students appreciating the communicative aspects, others appreciating the centralised file storage, and others mentioning awareness features such as the recent activity list and file statistics.

Makes it very easy to upload files that everyone can see and communicate with the group; you can see who has submitted already and makes it easy to get feedback. I think in general it helps reduce some of the major difficulties when working as a group, especially in this environment when unless you schedule meetings you will probably only see your group members during one class in the week. (Anonymous Student, P1)

I really appreciated using GroupShare, it was a great tool, and reduced the amount of headaches I needed to go through in order to get the whole group on the same page. (Participant 35)

Online participants, the majority of whom were enrolled in unit M3, also provided positive feedback. Several such students stated that the live chat feature, and other communicative features, helped to alleviate the isolation often experienced by online students.

As an external student, the GroupShare offered relief from studying in isolation and gave a real sense of participation, belonging and interaction with other students. (Anonymous Online Student, M3)

Online study can be an intensely personal and lonely experience but Groupshare was a great way of having a group space to share and interact. The layout is very practical and easy to manoeuvre. All recent activity can be seen at a glance on the home page and it was easy to see who was logged in and what they said when you were offline. GroupShare enhanced my experience of working in a group. (Anonymous Online Student, M3)

Some students described being initially hesitant to use GroupShare, mainly due to its unfamiliarity or not seeing a need for it, and grew to enjoy and appreciate it throughout the usage period.

I struggled to get a hang on using the online Groupshare tool at first but have slowly found the usefulness that such a tool can bring to group projects. .... As the semester has progressed, I have really found the benefit of this tool as it allows my team to communicate effectively without having to be face-to-face and working full-time really takes away a lot of opportunities of face to face communication. Groupshare also allows me to login, read and reply to other group members when it's convenient for me which has proved very beneficial. (Anonymous Student, P1)

My initial thoughts were that it [GroupShare] was really unnecessary and that as a group we could manage easily with just the usual forms of communication such as regular meetings, email or an instant messenger service over the internet. .... Overall after using GroupShare for some time I've found that it does make things much easier and more manageable when working with groups in different units, it gives the opportunity of every member to stay on top of group work and communication throughout the semester with little effort. (Anonymous Student, M3)

Comments such as these emphasise the benefits and role of groupware in supporting group work, particularly when much of the work occurs online, and the importance of awareness in such environments – topics discussed in the literature review (Chapter 2). A number of students mentioned their dislike of group work, their preference for individual work, or previous group work experiences that were troublesome – sentiments repeatedly expressed in the pre-usage questionnaire. A number of these students then went on to describe how GroupShare and its awareness mechanisms facilitated a successful and enjoyable group work experience.

From past experiences I personally have found group work irritating and most of the time, less productive than if doing the work alone. .... The use of the working tool 'Group Share' aided us greatly in our work, especially in the circulation of different parts of each report. .... The overall effectiveness of our group and 'Group Share' for the most part was exceptionally good. (Anonymous Student, M3)

I normally don't like group assignments because in my time at university I have never been in a group where a group assignment was properly organised within the group. .... With GroupShare it is easy to see how much effort a group member is actually putting into the assignment. Being able to see whether someone has done some work and uploaded it, viewed someone else's work, downloaded a copy of the work, and even logging into the GroupShare application is a great help. (Anonymous Student, P1)



One student who had always found it easier “to work alone as an individual and not in a team” described how their group “could not meet during the week days because of earlier commitments but the group share application bridged this gap and provided allowed us to work on our assignments when we managed to get online” (Anonymous Student, P1). The logistical issue of organising group meetings was mentioned frequently in the pre-usage questionnaire as a reason for disliking group work.

The post-usage questionnaire requested open-ended criticism and suggestions for improvement of GroupShare, which have been summarised in Table 4.73 and Table 4.74. Many of the issues raised in these responses were echoed in students’ reflective pieces. Some students, whose groups worked primarily face-to-face, felt that GroupShare and its awareness mechanisms did not represent their group well.

The software Group share was quite helpful in terms of uploading files for other group members to read and comment on. However, I feel because of the interactive nature of our tutorials most of the work is done face to face. As a result the group share may not always reflect the actual work being done by the group or its group members. (Anonymous Student, P1)

I do not believe it [GroupShare and its awareness mechanisms] represents our group realistically. We get a lot of issues, problems and work done while we are in class. Group Share does not actually represent this in any way shape or form. (Anonymous Student, P1)

Most negative feedback regarding GroupShare pertained to minor issues and suggestions for additional or improved features. These have been summarised in the aforementioned tables and are discussed in Section 7.1.1, however further examination of them is outside the scope of this research as they pertain to individual elements of the application and not the awareness mechanism itself.

### **6.1.2 Participation Awareness Mechanism Feedback**

The post-usage questionnaire contained open-ended questions regarding the participation awareness mechanism, however students completing reflective pieces for their unit were not instructed to comment specifically on the mechanism. Regardless, numerous students did so. These ranged from general supportive comments such as “Groupshare also showed us who was participating and who wasn’t.

This clearly reflected what we knew was true” (Anonymous Student, M3) and “the ability to view the relative activity of group members proved useful, especially for knowing who had to be ‘prodded’ to try a little harder” (Anonymous Student, M3), to deeper feedback which addressed various elements of the mechanism. Numerous students recognised the limitations of the mechanism, in particular its inability to autonomously judge the quality of work or recognise work done outside of GroupShare, but still saw value in it.

I liked the feature that shows you who is doing what in terms of activity. I can see how it can be taken out of context (ie if someone’s role is to find articles and not edit works, he/she graph will look decidedly one sided to another’s) but overall is a good indicator of how the group the going. (Anonymous Student, M3)

While I see the possibility of manipulation of the PA ratings, the end result matched the levels of effective participation. So while there are inaccuracie in the measurement process, it all came out in the wash. (Participant 10)

Similarly, some students recognised the potential for the participation awareness mechanism to be manipulated via spamming or noise – Participant 22 stating that the mechanism “was very accurate on how much people were participating if those people weren't spamming and just trying to get stats.”

The metrics used by the mechanism received a few comments, with students pointing out the metrics they felt had too great an impact. These were typically passive actions such as logging in and viewing content, or actions such as commenting or posting in the forums, which could be done quickly and easily without necessarily contributing anything of value.

Viewing files influenced the PA feature more than i expected and i do not feel that viewing files gives an accurate idea of group members participation. It shows they looked at the file but i think submission better reflects their participation. (Participant 56)

Useless comments such as smiley faces affected the overall PA, which made one group member look like they had done more work than they had. (Participant 25)

The various presentation styles of the participation awareness mechanism received some comments in open-ended responses. As these comments relate directly to the

second supporting research question, the majority of them have been reserved for discussion in Chapter 7. The primary theme which emerged from these comments was that the availability of multiple styles was appreciated, with different students preferring different styles, and some declaring that they made use of multiple styles.

Comments such as “I think the 2 complex styles are a little too complex for normal use. I can understand them mainly but i have to focus on them and not just glance at them” (Participant 55) and “I don't think I'd use anything but simple graphics” (Participant 60) indicate that some students found the complex styles too complex to deliver at-a-glance information. However, other students found such styles to be useful – “As a technically minded person, I generally prefer list/text-based output with some minimal graphics such as the UP/DOWN/NEUTRAL icons for Complex Text layout” (Participant 11).

Students who responded negatively to the participation awareness mechanism often cited its limitations as the reason, finding that the potential of manipulation and the inability to assess quality or recognise work done outside of GroupShare made the mechanism of little value or use. This was sometimes expressed as criticism of the mechanism’s accuracy.

I believed the pie chart is not an honest observation of which student has actually attempted or completed any of the given work. This was due to the automatic participation points given by logging in on the website, or by posting a thread. This is an unfair disadvantage as many students have actually completed the work given, as compared to other students who may have participated due to their participation points, but have not completed any of the work. (Anonymous Student, M3)

I don't feel it has real relevance to group projects due to it's lack of accuracy and groups shouldn't focus on it too much. it's still a nice guide to have if not too much importance is put on it . (Participant 60)

These limitations, and the way in which they influence perception of the mechanism, are discussed in Chapter 7. The presence of the participation awareness mechanism encouraged some students to be more active within GroupShare. While there were numerous reports of this being expressed in a constructive manner, there was also

evidence that some students performed inane actions simply to gain points in the participation awareness mechanism.

The resultant competition to have the best 'score' caused some members to post useless documents, comments and information. (Participant 25)

I have noticed that some people post a pointless reply just to get more posts behind their name. They can also say a post is work related when it is just about how cool balloons are. (Participant 53)

One student found that the participation awareness mechanism emphasised the lack of activity from their group members, resulting in a decrease in motivation.

The Groupshare website has made working and collaborating with my fellow team members easier, however the websites usage statistics have had the opposite effect to what I thought they would. .... I found that by seeing when and how often my fellow team members logged in was actually a demotivating factor as it gave me the impression that the other team members were not as committed to the project as I was. (Anonymous Student, P1)

This comment relates to the importance of group work in online learning, as discussed in Chapter 2, and the concept of 'social presence' in online environments. Numerous pieces of literature have examined the effect of social presence, defined as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (Short, Williams, & Christie, 1976), in distance and online learning. Of particular relevance in this student's experience is Weaver and Albion (2005), who "confirmed the existence of a relationship between learners' perceptions of social presence and their motivation for participation" and stated that "highest rated social presence factors were related to course work and the lowest rated were incidental social interactions." While these findings were in the context of asynchronous online discussion, the author feels that they are highly relevant to the cited student's experiences.

The majority of feedback regarding the participation awareness mechanism was positive. While some students did not appreciate the mechanism overall or felt that its limitations made it of little value, no participants expressed an explicit dislike of the mechanism.

## ***6.2 Post-Usage Questionnaire and Reflective Pieces Summary***

The qualitative data gathered in the post-usage questionnaire and the reflective pieces of units P1 and M3 added substantial richness and depth to the quantitative data gathered in this research. Students who participated in the research were able to express their views and responses in a detailed and meaningful manner. The reflective pieces gathered as part of units P1 and M3 was of particular value, as it was not a source of data requested or shaped by the author, minimising the potential for any form of bias or influence upon responses – students in units P1 and M3 were required to complete their reflective pieces irrespective of the research. As the preceding sections have illustrated, the feedback regarding both GroupShare and the participation awareness mechanism received from the reflective pieces correlated with responses received via the research's own data collection techniques. Overall, students found GroupShare to be a useful, intuitive and appropriate groupware application which was effective in supporting their group-based studies, and the majority of students found the participation awareness mechanism to have a positive impact on them and their group members.

## ***6.3 Interviews***

Attending an interview was an optional component of the research, which participants were able to opt in for if desired. Checkboxes to opt in for the interview were present in both the consent form and the post-usage questionnaire. While 15 participants checked the box in the post-usage questionnaire, only two of them responded to the follow-up e-mail and were able to attend an interview. A third student, who did not provide a full set of data, also attended one of the interviews. Similarly, only one staff member responded to e-mail requests for an interview. The low response rate was expected, as both students and staff are typically pre-occupied with assignments and exams towards the end of semester, when the interviews were conducted.

Despite the low response rate, the interviews were able to achieve their goal of providing a supplementary data source. The interviews represent a qualitative examination of a small number of cases, offering a deeper perspective from which to examine the response to GroupShare and the participation awareness mechanism.

Due to the number of interviews and their semi-structured nature, the following subsections do not contain full transcripts or adhere to a strict question-and-response format. Instead, a format that the author feels better encompasses the structure of the interviews, as outlined in Section 3.4.5, has been utilised. All substantial and relevant data gathered through the interviews has been reproduced and placed in the most appropriate context.

### **6.3.1 Interview with Participant 20**

The first student interview was conducted with Participant 20, a male student over 50 years of age who was in unit P1. This participant's group demonstrated quite a low amount of GroupShare usage, with responses to the participation awareness mechanism being primarily mild or neutral, suggesting that it did not have a profound impact on the group. The duration of the interview was 29 minutes.

The interview began with questions regarding how frequently GroupShare was used, and what it was used for during the usage period. "Only when we were doing the group stuff. To be honest, when we were doing the subject work by ourselves I didn't use it at all. .... I have logged on a couple of times since, and the team I was with – no one else is still using it either." This is representative of the typical usage pattern of students in unit P1, as discussed in Section 5.1.1. Participant 20 was satisfied with his group's performance and outcomes, and felt that this was facilitated by the use of GroupShare to manage group work. "[GroupShare] probably made it a little bit easier in that you didn't have to be meeting outside of regular class to make sure we had a copy to work on. From that point of view it was actually a lot better for a group situation – you could upload all the stuff onto the group site, rather than emailing it or trying to meet."

The next questions concerned two awareness-related features of GroupShare, the file statistics and the trophies (described in Section 3.6.1). Neither feature received much attention from Participant 20 or, to his knowledge, from the rest of the group. He responded, "We didn't really worry about it too much. Most of us, you could tell by the little pie chart, most of us were fairly equal across it anyway" in regards to the file

statistics, and “Never worried about them. I think I got about three of them, I think” in regards to the trophies.

Participant 20’s group met on a weekly basis, during class time devoted to group work. While the group did not use GroupShare during these meetings, content produced at this time was uploaded to GroupShare to be worked on throughout the week. “We put stuff up, and during the week we would update it ... work through it, put all our own bits in.” The lack of a version control system was mentioned as problematic, as multiple versions of a file were often uploaded, leading to some confusion.

The next question asked Participant 20 if he felt that GroupShare’s inability to take face-to-face work into account had the potential to skew the participation awareness mechanism, to which he responded “Probably, but it’s not something that was terribly important. Unless there was some sort of penalty for really drastic under-representation on the system.” Concerns regarding academic penalties or consequences based on the participation awareness mechanism were mentioned by several participants, emphasising the need to clearly document any and all such usage of the document – an issue further discussed in Chapter 7. Probing questions evoked further discussion on the topic of inaccurate participation awareness. “You might have, in a team, someone that can write up all the ideas really well – so they do all the stuff on the system, which might skew their participation .... Whereas other people have done all the face-to-face work, but their participation doesn’t appear on the computer.” Participant 20 then stated that despite the potential to be skewed by face-to-face work, the mechanism could still serve as a tool to highlight potential workload issues within a group.

The second half of the interview focused upon the participation awareness mechanism, with the first question asking Participant 20 if he felt the mechanism influenced the way his group worked. “Not really. I know some of the other groups made a point of that, but we didn’t.” Probing questions asked if the participation awareness mechanism was discussed in the group, disliked by any group members, or made the group work more competitive. All received negative responses such as “It just didn’t come up”, suggesting that the mechanism had little impact on this group. In

further discussion, Participant 20 expressed that the mechanism may have more use or impact in a group project over a longer period.

The interview continued with questions regarding the metrics of the participation awareness mechanism, in particular the potential for manipulation of the mechanism and the limits implemented in order to deter this. Participant 20 did not notice any attempts at participation awareness manipulation in his group, and while he had a vague idea of how the mechanism operated, he did not pay it much heed. “I glanced at some of the stuff a bit, everyone appeared to be doing about the same – getting onto the system and doing something.” When asked if the representation of his group members in the participation awareness mechanism matched his own perception of their participation, Participant 20 responded positively.

Understandably, given the low attention paid to the participation awareness mechanism, Participant 20 reported not noticing the issue of quality versus quantity. When asked, he acknowledged the mechanism’s inability to determine quality autonomously, stating, “Trying to assess that on a computer is going to be almost impossible anyway.” He also did not make use of the rating feature, but did feel that it had potential as a qualitative metric. “If it was a way of determining the quality of what people are putting up, and it was made a necessary requirement for a particular situation, then it’s probably got its uses. But just as a voluntary thing – some people will use it, some people wont.”

Participant 20 used the Simple Graphics presentation style almost exclusively, “because it was more visual, you could get a rough idea – all the bits [segments of the pie charts] were approximately equal.” When asked if he felt it was useful to have multiple styles available, he responded positively, stating, “I can see the point of having other things in there, for specific purposes that you might want the underlying stats for” in regards to the Simple Text style, and mentioning that the Complex Graphics style could be useful in long-term projects.

While the impact to him and his group was minor, Participant 20 felt that the participation awareness mechanism was beneficial to his group overall. “It’s good to



have it in there for some sort of overall level of measurement. I know with our group there were a couple of people who for work reasons or whatever couldn't make it every week, but you can see that they're actually logging on and accessing files and doing stuff at home."

### **6.3.2 Interview with Participant 21 and Student 1**

The second student interviewee was Participant 21, who was a male between 21 and 30 years of age in unit P2. One of his group members, who did not complete the post-usage questionnaire, also attended the interview. This student was identified as Student 1 in Section 5.3.8, and fell into the same demographic range as Participant 21. Both Participant 21 and Student 1 demonstrated substantial usage of GroupShare over an extended duration, and responded positively to the participation awareness mechanism. A high level of GroupShare usage and positive response to the mechanism was widespread in their group, which was examined in Section 5.3.8. The duration of the interview was 48 minutes.

The first questions regarded the group's usage of GroupShare. The group used the application in a project involving the planning and development of a retail Web site. Participant 21 stated, "We used it as a backup for our files. We used it at the very start to do a lot of our communicating." Student 1 added, "I'd actually go as far as saying that we used it as our primary source for our file storage." Participant 21 also mentioned using other features such as the private group forum, and both interviewees remarked that sophistication of the live chat could have been improved.

Both interviewees felt that the group work experience compared well against prior group work, Participant 21 saying it was "probably the best group I've been with", and describing previous group work situations in which he experienced unequal participation. When asked if they felt using GroupShare influenced the quality of the group work experience, Participant 21 responded with "yes, definitely", and described how GroupShare made it possible to remain on task despite a chest infection and other assignment work. Student 1 added, "I did also find it good in the regard that it made it easier to see how far through the project we had progressed."

The next questions concerned the trophies and file statistics. Both interviewees were enthusiastic about the trophies, Participant 21 stating, “The trophies were good .... I actually really liked them.” Both Participant 21 and Student 1 mentioned that the trophies encouraged activity and some competitiveness in the group, however for the most part this was expressed constructively. “Most people waited until we actually gave the presentation and handed it all in before spamming” (Student 1). When asked about the file statistics feature, both interviewees responded quite neutrally – stating that little attention was paid to it, but that the statistics were fairly useful to have available.

The interviewees’ group had meetings twice weekly – a face-to-face meeting during class time, and an online meeting on another day of the week. Due to a lack of sophisticated features in GroupShare’s live chat, the group used another application to host their online meetings. When asked if GroupShare was utilised during the meetings or if the group attempted to record the events of meetings in GroupShare, Participant 21 indicated agreement and reported that “the [chat application] had logging, so we were actually able to log what was said, then we submitted it as a text file onto GroupShare.” Neither interviewee felt that GroupShare’s inability to take face-to-face work or work done in other applications into account skewed the participation awareness mechanism in a noticeable manner. The next question asked if the interviewees felt that GroupShare would be more useful for fully online groups, to which Participant 21 responded, “Yeah, it would be very good for online. I think it’s still good to have for face-to-face, but the real benefit would be definitely online.” Both interviewees said that they would still use the application even if working primarily face-to-face, with Student 1 saying, “It’s just a lot more convenient, just to put the stuff up there.”

The second half of the interview concerned the participation awareness mechanism, firstly asking if the mechanism influenced the way the group worked. Both interviewees responded with “Yes.” Participant 21, who was the group’s leader, described using the participation awareness mechanism to notice that a group member was not participating, and then to monitor the participation of the group member once he had been contacted with the group’s concerns. Student 1 echoed

these sentiments - “Not only did it help us try to move him on a bit more, but it helped us to see, more quickly and easily, that there was a problem there.” Both interviewees responded positively to the participation awareness mechanism overall, with Student 1 stating that it “helped to give us a little bit of an idea that we were keeping up” and Participant 21 adding “And seeing who was actually participating. .... It was interesting to see people’s work patterns.”

Questions regarding the manipulation of the participation awareness mechanism were met with similar responses to those regarding the trophies. Both interviewees reported that attempts to manipulate the mechanism were only made at the end of the group work, in the spirit of competitive fun rather than a sincere attempt to misrepresent participation. GroupShare’s awareness features made it easier for group members to notice when a member was creating spam – “with the recent activity, we could easily see who was spamming” (Participant 21). Both members noticed the limits applied to the mechanism, and felt that they were suitably effective in filtering spam and noise. Student 1 suggested “a bigger gap between each count” in regards to logins, to ensure that points are not awarded to multiple logins within a short period of time.

The next questions concerned the quantitative nature of the participation awareness mechanism, and how this affected the group’s perception of it. Participant 21 recognised the issue existed, but felt that his group’s usage of the qualitative features within GroupShare ensured that the mechanism remained accurate despite being largely quantitative. “I viewed all the files anyway, most people did it, so we did see the document – So we did see if anyone had rated it, and if we found any errors or thought something needed to be updated, then we used the comments.” The rating feature was utilised during the latter half of the group project, primarily to rate finalised documents, but the impact of ratings on the participation awareness mechanism was not particularly noticed by either interviewee. Student 1 reported that “the ratings were more to let other people know whether we feel that it’s up to scratch,” and also suggested that the impact of ratings on the participation awareness mechanism could be greater on files and forum threads with extremely high or low average ratings. Probing questions resulted in discussion regarding the rating of the

participation awareness mechanism itself as a possible qualitative metric. Both interviewees felt that this would not be beneficial, as allowing potentially biased group members to influence the mechanism directly would detract from its autonomous and objective nature.

In regards to presentation styles, Participant 21 expressed a preference for the Complex Graphics style. “I had the complex graph. I did use the simple text quite a bit ... just to get the raw stats. I found the complicated text just a bit hard to really understand.” Both Participant 21 and Student 1 preferred the Complex Graphics style above the Simple Graphics style which was preferred by most participants. “The thing with the pie graphs is that it doesn’t show you what’s been happening over the whole project” (Participant 21). Student 1 preferred the Simple Text style, but also used Complex Graphics. Both interviewees felt that having multiple presentation styles was important.

Overall, both interviewees responded very positively to GroupShare and the participation awareness mechanism. Multiple mentions were made to the accuracy and usefulness of the mechanism, with both interviewees feeling that it allowed them to spot, address and monitor issues of non-participation with greater effectiveness.

### **6.3.3 Interview with Staff Member of Unit P1**

The staff member who attended an interview was that of unit P1, who also taught unit M3 in the main iteration of the research. This staff member has supported prior research by the author (Baatard, 2006), and has substantial interest and experience in the areas of computer-supported and online education. The duration of the interview was 30 minutes.

As detailed in Section 3.4.5, the first half of the interview concerned general group work and GroupShare usage within the unit. The first questions concerned the student response to the fact that the unit required group work, and how this compared to the response in prior instances of the unit. According to the staff member, students in P1 responded quite well, as they “were all IT students [and] most of them have had

experiences working in groups.” Prior instances of the unit were not typically as positive towards group work, with some students being “quite negative, because they’ve had bad experiences in the past.” Despite the positive appearance, the pre-usage questionnaire indicates that the majority of participants from P1 had some reservations regarding group work, with the most responses being negative – consistent with the other units.

GroupShare was the next topic of discussion, with questions concerning the student response and usage of the application. The response to GroupShare was positive, with the staff member stating that the in-class demonstration at the start of the usage period gave students the impression that GroupShare was “a useful thing, because they’ve always had problems in the past where they’ve had to send multiple emails to people.” Overall, “this group seemed to take it on board quite easily. I didn’t get any feeling from anyone of any negativity at all.” The staff member reported seeing students using GroupShare in class, during group-based work, and seeing plenty of evidence to indicate high usage outside of class. “They certainly appeared to be using the groupware fairly extensively. .... They appeared to be using it effectively.” The only negative feedback regarding GroupShare’s features was in relation to files, with some students desiring wiki-style editing capabilities or more sophisticated methods of version control.

The next questions related to student performance in the unit, and whether the staff member felt this was influenced by the use of GroupShare. Student performance in the unit was of a high standard, with the staff member attributing some of this to the usage of groupware applications. “The kids did very well. .... I’ve found since I’ve been using groupware products, in the last two years, with either a wiki, or Reportal or now GroupShare, I have found that they have produced much better group assignments than they did previously, when we didn’t use a groupware product.” Reportal is the name of another groupware application developed by the author for prior research (Baatard, 2006). When asked if she felt that the use of GroupShare influenced student performance, the staff member responded “It does I think, it gives them a facility to work in a space”, with GroupShare’s robustness and ease of use being mentioned as particular advantages.

The half of the interview regarding the participation awareness mechanism began with questions concerning the four presentation styles, a printed example of which was provided. Like the student participants, the staff member found the Simple Graphics style to be the most visually appealing, “I think the easiest to read is probably the pie graph ... because it’s up front and in your face.” Probing questions regarding the presentation styles resulted in the staff member discussing the value of having multiple styles of presentation. “I actually think all four provide you with a range of information. .... I think all four are very valuable.” Particular mention was made of the Simple Text style for providing distinct information about “who’s working and who’s not” and Complex Graphics for showing *when* activity had occurred.

In regards to which presentation style she felt provides the most useful information to students, the staff member said, “Knowing the way students work, the Simple Graphics is what they’ll look at first. .... Then I think they will look at the Simple Text, rather than the Complex Text – because that’s actually quite difficult to read.” The usage data and post-usage questionnaire confirms that most participants did indeed prefer the simple styles. When asked which presentation style she felt provides the most useful information to staff members viewing student participation, the value of multiple styles was again emphasised. “I actually think all four – I wouldn’t ignore any of them, because they’re giving me different information about what the students are doing.” The Complex Graphics style was deemed particularly valuable to staff, as the graph’s chronological nature allows issues such as the adoption rate of the software and any lulls in usage to be identified and responded to rapidly.

The following questions concerned the metrics of the participation awareness mechanism. Overall student response to the participation awareness mechanism was largely positive, with the staff member reporting that it “made them more aware of who’s contributing and who wasn’t. .... I think they found it very useful in keeping people on track, and keeping people on time.” Judging by the reflective pieces, the staff member felt that a small proportion of students did not realise “that the awareness factor was weighted, and thought that it was just an indication of how many times they’d gone in. .... It appeared they didn’t understand that they couldn’t log in six times and get six points.”

In response to questions concerning the quantitative nature of the mechanism, the staff member mentioned that some students pointed out “that you could upload six files and they might be six files of rubbish, so it becomes meaningless.” The staff member felt that the potential for this was minimised by the need to complete reflective pieces at the end of the semester, in which such activities could be anonymously reported by students. The pressing need to complete the group work was also thought to deter students from attempting to manipulate the participation awareness mechanism – “they very quickly settle down and get stuck into the task.” Therefore, while the potential for abuse and inability to assess quality was noticed by students and the staff member, it did not become a major issue.

The final question of the interview asked if the staff member would consider using the participation awareness mechanism to guide decisions relating to student participation in group work, such as determining if a student has participated, or dividing marks between group members. She responded, “No ... it’s a pure group assignment where the groups are purely autonomous” and pointed out that the group assignment was only worth a small number of marks. “If I was making the assignment worth more, then yes – I probably would use the participation awareness feature to try and ascertain who was doing what.”

The staff member’s final thoughts regarding GroupShare were “It’s great – much better than the wikis.” She expressed an appreciation of GroupShare’s ease of use for both administrators and end users compared to other forum and wiki-based tools, and felt that it was more in line with the pedagogical aims of the school.

## ***6.4 Interview Summary***

Despite the limited sample size, the student interviews were able to add to the research by enabling in-depth examinations of individual participants and their groups. The participants in the two student interviews offered an interesting contrast; Participant 20 exhibited shorter and lesser usage of GroupShare and did not find that the participation awareness mechanism had much of an impact, while Participant 21 utilised GroupShare heavily over an extended period and found the participation

awareness mechanism had a considerable impact. For the most part, these attributes were found to extend to the other members of both participants' groups.

Both student participants responded well to GroupShare, finding it to be a suitable groupware application to support the tasks required in their respective units. Some desired improvements to the application were mentioned by both of the interviewees, primarily regarding the implementation of a version control system for submitted files, and the improvement of the live chat feature. These suggestions reflected those made by numerous participants in the post-usage question. Participant 20 did not use or form an opinion of several features of GroupShare, unlike Participant 21, who made substantial use of most of GroupShare's features throughout his group's usage period. The fact that both of these participants, who demonstrated considerably different usage of GroupShare, responded positively to the application is in accord with the findings amongst other data sources, and further establishes GroupShare as a suitable environment in which to research the participation awareness mechanism.

While Participant 20 and his group did not pay much heed to the participation awareness mechanism, he felt that it was still of some value as an awareness tool and to provide some overall indication of participation. Participant 21 and his group paid substantial attention to the mechanism, and made use of it to notice, respond to and monitor the participation of themselves and other group members. The participation awareness mechanism, and also the trophies, were found to inspire activity and some competitiveness in Participant 21's group, however this was largely expressed in a constructive manner. Although not evident in the groups of either interviewee, responses to the post-usage questionnaire, particularly to open-ended questions, reveal that some participants did feel that the mechanism encouraged inane activity. Neither interviewee reported a negative response to the participation awareness mechanism, or felt that any of their group members disliked it.

Although not specifically noticed by Participant 20, both interviewees were aware of the quantitative nature of the participation awareness mechanism. Neither of them felt that it was a limitation or flaw in the mechanism, with the interviewees recognising that autonomously assessing the quality of actions and contributions was not feasible.



Participant 21 and Student 1 felt that the autonomous and objective nature of the mechanism was beneficial, as it shielded it from inaccurate assessments of quality or the potential bias that could be introduced by implementing user-driven methods of indicating quality. Numerous participants mentioned the issue of quality versus quantity in the post-usage questionnaire, with the data suggesting that while some felt it made the mechanism less useful, many were of the same or similar opinion as the interviewees. Similarly, both interviewees recognised the mechanisms inability to account for actions which occurred outside of GroupShare, but accepted this limitation and did not find that it had a significant influence in their groups. The under-representation of a group member who works primarily outside of the groupware environment was seen as both an actual and a potential issue by some participants.

Participant 20 and his group did not make use of the rating feature in GroupShare, while Participant 21 and his group did. The interviewees recognised the potential of using a rating feature to introduce a qualitative element to the participation awareness mechanism, but suggested changes in order to make this effective. Participant 20 felt that rating would need to be an enforced requirement, and Student 1 suggested that contributions with extremely high or low average ratings should have greater impacts on the mechanism. None of the interviewees appeared to be overly enthusiastic towards the concept of the participation awareness mechanism having a heavy reliance or emphasis upon ratings, a feeling that was evident in participant responses to section 5 of the post-usage questionnaire (Section 4.4.5).

Participant 20, who had quite a low level of GroupShare usage and exposure, utilised the Simple Graphics presentation style almost exclusively, while Participant 21 and Student 1, who made heavy and prolonged use of the application, both made use of the Complex Graphics style. Participant 21 appreciated the simplicity of the pie charts, while Participant 21 and Student 1 appreciated the sophistication and detail offered by the graphs. As described in Section 5.5.7, complex presentation styles were typically preferred by participants who demonstrated a high level of GroupShare usage. All interviewees felt that offering multiple presentation styles was of value, to satisfy both personal preferences and the need for particular types of information.

The interview with the staff member of unit P1 offered a staff perspective on the areas of research. The first portion of the interview evoked responses which correlated with the other data sources regarding P1 – that students found GroupShare to be a useful tool, and made effective use of it to support their group work. Students in P1 performed well, and the staff member felt that this was aided by their use of GroupShare, echoing the positive feedback received in the post-usage questionnaire.

The staff member's thoughts regarding the participation awareness presentation styles matched those of the participants very closely. She felt Simple Graphics and Simple Text were the most accessible due to their at-a-glance nature, but also recognised the value of the complex styles and the benefit of offering multiple styles. The staff member recognised the potential for the mechanism to be inaccurate or deliberately manipulated, but felt that this was minimised by the students' pressing need to complete their work and an awareness of accountability.

Both the staff interview and the student interviews were able to enrich the findings of the research. Examination of this qualitative data source has served to substantiate and expand upon the trends and themes that have arisen throughout the research. This was further enhanced by the qualitative data found in open-ended questionnaire responses and the reflective pieces completed by students in units P1 and M3.

## **Chapter 7 – Discussion and Conclusion**

Following the analysis of both the quantitative and qualitative data gathered, this chapter discusses the issues and findings of the research and presents a conclusion based on the thesis research questions. First, the core elements and issues which arose in the research are discussed, including the response to and suitability of GroupShare, the viability of qualitative metrics, and the issue of face-to-face and out-of-system activity. Next, the research questions are addressed and a model of participation awareness is presented. Lastly, the conclusions summarise and consolidate the outcomes of the research and present possible areas for further study.

### ***7.1 Elements and Issues of Note***

Throughout the research, a number of issues were regularly raised, both by participants and by academic staff members to whom research overviews were provided. These topics are addressed in the following sub-sections, utilising evidence from the data, the research literature, and knowledge the author has garnered over the course of this research and previous studies.

#### **7.1.1 Participant Response to GroupShare**

While not a focus of the current research, the GroupShare application was a significant element in the study. As detailed in Section 3.6.1, GroupShare was designed to be a generic groupware application and a suitable platform for research into a generically applicable participation awareness mechanism. GroupShare was intended to support the loosely-coupled asynchronous collaboration typical of collaboration undertaken in many educational and enterprise environments. The design of GroupShare aimed to incorporate common features and ease of use to create a highly accessible application, coupled with a rich set of awareness mechanisms (Baatard, 2008). The participant response to GroupShare is important, as the groupware environment has the potential to influence the participants' perception of and response to the participation awareness mechanism. For example, if participants found GroupShare to be a burden to use, this could negatively bias the response to the participation awareness

mechanism. By examining the participant response to GroupShare, the following discussion aims to establish its suitability for the research aims.

The second section of the post-usage questionnaire (Section 4.4.2) was dedicated to feedback concerning GroupShare. Responses to this section revealed that GroupShare was well received by the large majority of participants. Particularly important in determining GroupShare's success and suitability as a generic groupware application were two questions in this section. Question 9 asked participants if the design and interface of GroupShare allowed them to use the system effectively, and question 10 asked them if the application was well suited to support the tasks required in their group. These questions received a 92% and 84% positive response respectively, indicating that GroupShare was successful in providing an accessible and useful groupware environment. Strongly positive responses to questions regarding the impact and effectiveness of GroupShare further establish its usefulness, as does the 83% positive response to question 14, which asked participants if they would like to use GroupShare again in future group work.

The application also received positive open-ended feedback in both the post-usage questionnaire and the reflective pieces of units P1 and M3. Numerous open-ended responses such as "Group Share is easy to use and has an intuitive interface that requires minimum take-up time" (Anonymous Student, M3) mentioned the accessibility of GroupShare, while others remarked upon the range of features available:

We have done most of our communications through Groupshare. We have opportunity to upload our own file and can download other group member's files as well which saved lot of our time. We also can chat through the chat room while busy with other work. If any one wants to leave any message for the group members, there is option for that. Group members can upload their profile and details which is really handy for the other members. Recent activity logs record all the recent changes so we know which one is the latest update. I mean GroupShare give us a feeling like we are always inside the group while you are actually not present in physically. At the end, all I can say GroupShare is an ideal website for group work and I am having fun to work with it. (Anonymous Student, M3)

As one of the application's design goals was to provide a high degree of awareness, it was encouraging to see open-ended responses that commended upon GroupShare's awareness mechanisms. Feedback regarding the participation awareness mechanism was common, although other awareness mechanisms and elements were also mentioned:

One feature of GroupShare I found useful was the indications of who in my group had read and responded to the drafts. The notification regarding views and comments provided motivation knowing that others were reading and perhaps benefiting from some my work. It also inspired me to review other's work. The transparency of the notifications was a great motivator. (Anonymous Student, M3)

I particularly like the audit trail information provided in the Participation Awareness and Recent Activity areas as it indicates who has accessed the group, when they accessed the group and whether they have posted any messages or files. The annotation of 'New Replies' in Forum section and 'New' or 'Commented' in the Group Files section saves time as you only need to access the thread or files with new entries. (Anonymous Student, M3)

Overall, a large number of open-ended responses praised GroupShare, with the majority of comments covering the interface, communications features, file sharing and awareness features. No significant differences were found in participant responses to GroupShare amongst the different units, groups or user profiles examined in Chapter 5. In view of the quantitative and qualitative evidence from this study, the author is confident that GroupShare was an accessible and generically applicable groupware environment suitable for the examination of participation awareness.

As with any new piece of software, there is room for improvement. Question 16 of the post-usage questionnaire asked participants which aspects of GroupShare they liked the least, and question 17 asked them how they felt the application could be improved. Both of these open-ended questions sought the negative feedback that research participants may be reluctant to provide. The majority of suggestions concerned the improvement or expansion of existing features, and suggested that while the core functionality was present, some participants desired the sophistication offered in other, more established, applications. These suggestions included better file structure and management (including version control) and a more robust live chat

feature. Requests for better file structure and management were quite frequent, validating the findings of Mark and Prinz (1997), who emphasised the need for the establishment of consistent naming conventions in groupware environments. Mark and Prinz make recommendations concerning groupware design to facilitate effective file sharing, which will no doubt prove useful in further development of GroupShare. In relation to participation awareness, a more sophisticated form of file sharing and version control could allow for metrics which more accurately represent the value of actions performed by users.

Some participants suggested features which were not present in GroupShare such as video conferencing, e-mail or RSS activity notifications, and integration with other systems and applications. Many of the new features and improvements suggested were considered in the development of GroupShare, but not implemented due to time constraints, technical limitations, and the desire to keep the application easy to use and generically applicable. The feedback will be taken into consideration in the future development of GroupShare, which may lead to its release as a publicly available or commercial product. Further development of GroupShare may result in the addition or modification of features in a manner that allows for a greater number of participation awareness metrics and improved precision of the metrics model.

### **7.1.2 Qualitative Metrics**

Being fully autonomous, the quantitative nature of a participation awareness mechanism is an obvious issue of note, and one that was raised by both participants and academic staff members in this study. Despite applying values and limits to the participation metrics, relying on their quantity with little acknowledgement of their quality appeared to some participants as a failing of the mechanism. However, most were quick to realise that autonomously assessing the quality of contributions in a groupware environment is unfeasible. This viewpoint is supported by the sparse amount of literature found on this topic. Even analysing the content of online group discussion via the frameworks presented by Henri (1992) and Hara, Bonk and Angeli (2000) is a complex and involved process requiring manual coding of content. An analogy the author became fond of during the research points out that while the

mechanism does not distinguish between a well-written report and last week's shopping list, doing so would be of little value as last week's shopping list may indeed be a valuable contribution in a project concerning household spending. Hence, while it may be theoretically possible to attempt autonomous qualitative analysis of contributions through both simple techniques such as file size and keyword matching and advanced content analysis, implementing the logic that determines what constitutes quality is complex and inescapably subjective in nature. Each group using a groupware environment may have different tasks and objectives, making generically applicable and autonomous quality assessment highly unlikely. Reliable autonomous qualitative analysis is only feasible in environments where contributions can be distinctly categorised as 'right' or 'wrong'. An example of this would be an environment in which users were able to submit the answers to multiple-choice tests.

While autonomous and generically applicable qualitative metrics were not feasible within the scope of this research, there is potential in qualitative metrics that rely on users to give an indication of quality. The most viable and generically applicable of these, and one which was implemented in GroupShare, is a rating feature. By allowing users to rate the quality of a contribution on a simple scale, the average rating can be said to represent the perceived quality of the contribution. This rating can then be used to modify the value of the contribution within a participation awareness mechanism. Such a metric depends on users being willing to rate contributions, and doing so honestly. In the current research, the rating feature was available for both files and forum threads, and was under-used by participants. Less than half of the participants reported making an effort to rate the contributions of their group members in the post-usage questionnaire, with usage data showing that no ratings were given in 28 of the 53 active groups. A further 13 groups made 10 or fewer ratings. With the average number of files and forum threads per group being 52 and the average number of ratings per group being 10, it is evident that most participants did not consistently rate contributions. Some open-ended responses in the post-usage questionnaire attributed this to a preference for textual or verbal feedback and concerns that rating would not be appropriate in small groups. The effect of ratings on the participation awareness mechanism was mentioned in the documentation available to students. It is clear from the amount of use that the rating feature

received in the research that a voluntary rating feature cannot be relied upon as an effective qualitative metric.

Making ratings compulsory was suggested by some participants in open-ended questions and interviews as a method of improving its usefulness as a qualitative metric. Such a requirement is warned against in the literature. For example Carroll, Rosson, Convertino and Ganoë (2006, p. 16), Steinfield, Jang and Pfaff (1999, p. 85) and Dourish and Bellotti (1992, p. 109) all state it can burden users with extra work, cause distraction and lead to information overload or the disuse of awareness mechanisms. This is not a major issue if users have a personal motivation to provide the information, but given the low usage of the rating feature in GroupShare, it appears that most participants did not perceive it as beneficial to themselves or their group. Although Steinfield, Jang and Pfaff (1999, p. 85) suggest that “a mixed approach that combines embedded system logging with explicit but optional provision of information may be a useful compromise”, this research did not find such a solution to be effective in the current implementation. As a result, the author feels that forcing users to use a rating feature would be ill advised, since the distraction and annoyance of doing so is likely to outweigh the benefits of adding a qualitative element to the participation awareness. Since the rating feature was utilised by some groups for their own benefit rather than to inform the participation awareness mechanism and none of the participants expressed a dislike of the feature, this research finds no reason to avoid such a feature in groupware applications.

A feature with potential to serve as an alternative to a rating feature and be utilised as a qualitative metric is that of ‘labelling’. Rather than rating contributions on a scale, users are able to assign labels to contributions. Potential labels include ‘Draft Quality’, ‘Needs Minor Revision’ and ‘Approved Final Copy’. These labels are indicators of a contribution’s perceived quality or appropriateness expressed in a manner that has greater inherent meaning to users than a rating scale. Similar to a rating feature, users are able to re-assign the labels as appropriate. Since the labels have a greater inherent meaning and relevance to the task at hand, the author feels that users would be more inclined to make use of the feature consistently and honestly, thus bolstering its effectiveness as a qualitative metric. Use of a labelling feature as a qualitative metric



would consist of coding labels into appropriate modifiers to be applied to the points awarded for the contribution. The suitability of a labelling feature as qualitative metrics in participation awareness is worthy of further research.

Overall, the research found autonomous and generically applicable qualitative metrics to be unworkable. While qualitative metrics that rely on users have potential, it is difficult to ensure that such mechanisms can be implemented in a reliable and effective manner. Hence, even if some qualitative metrics exist, participation awareness mechanisms are likely to remain heavily quantitative within the near future. The most realistic and appropriate solution to the issue, at least in the short term, appears to be to educating the user about what a participation awareness mechanism is capable of and how it works. Information and documentation available to users should clearly state the quantitative nature of the participation awareness mechanism and emphasise that while values and limits are in place to give relative weightings to actions and to deter spam and noise, no attempt is made to assess the quality of actions. If the objectiveness of the mechanism is accentuated, users may perceive it differently. Ideally, users would recognise the autonomous and objective nature of the mechanism, accept the limitations in regards to quality and perceived accuracy, and interpret the mechanism subjectively based on their personal knowledge and perceptions of group members. It was evident in the post-questionnaire responses that some participants did not realise that ratings influenced the points awarded for file submissions and forum threads. Hence, documentation about the mechanism should also emphasise the existence and functionality of all qualitative metrics.

### **7.1.3 Face-to-face and Out-of-system Activity**

The second issue regularly raised by both participants and academic staff members related to the participation awareness mechanism's inability to recognise and include actions performed outside GroupShare. The metrics that inform a participation awareness mechanism are limited to actions which occur within the groupware environment. While this excludes actions using other technologies and software group members may use, such as e-mail and instant messaging applications, by far the most common concern voiced by participants in this research was that of face-to-face

interaction. “It [the participation awareness mechanism] could also reflect a false participation rate whereby people are not credited with the participation done off line” (Participant 51).

As with all groupware applications, GroupShare is obviously not able to recognise face-to-face interaction and incorporate it into a participation awareness mechanism. In this research 86% of participants reported having face-to-face contact with group members at least once a week. Contact via other methods such as telephone or e-mail was also quite common, with 47% of participants stating that this occurred at least once a week. Although a summary of face-to-face interaction or the work that results from it may be submitted to the groupware application, this does not necessarily reflect which group members contributed to it or how much they contributed, thus limiting its usability as a participation awareness metric. Hence, if any activity occurs outside of the groupware environment, the potential for this to skew a participation awareness mechanism remains.

A number of students noticed this issue and mentioned it in open-ended responses. For examples, “Didnt necessarily reflect each members output, as they may not have uploaded work, or may have helped with other peoples work” (Participant 5) and “may misrepresent how much work is actually done, just because your not logged online doesnt mean that your not doing the work” (Participant 34). Despite these comments, the data did not indicate that students found the issue to be a major problem or flaw of the participation awareness mechanism. It appears that students perceived it as a functional limitation of the mechanism, and while they recognised the potential for misrepresentation there were no reports of this having a substantial negative impact on the accuracy of the mechanism.

Similar to the issue of face-to-face and out-of-system activity is that of limited access to the groupware environment. Two examples of this were visible in the group-based analyses examined in Chapter 5, from Participant 14 in Group 5 (Section 5.3.5) and Participant 50 in Group 6 (Section 5.3.6). In the case of Participant 14, a lack of available time resulted in his usage of GroupShare being substantially less than that of fellow group members, resulting in lower participation awareness scores. Participant

50, as discussed in Section 5.3.6, had limited access to GroupShare due to a slow and unreliable Internet connection. In both cases the participants found the mechanism to be an inaccurate measure of their activity within their group. While Participant 14 responded positively to the mechanism despite finding it inaccurate, Participant 50 responded negatively, citing its inability to “reflect restrictions in access” as a reason.

It was suggested by some participants that a participation awareness mechanism would be more accurate and all-encompassing for groups working mainly online, with little or no face-to-face contact. While this is potentially true and is supported by the positive response to the mechanism amongst online students (Section 5.5.10), face-to-face or out-of-system contact is likely to occur at some stage in most group work scenarios. In this research, the post-usage questionnaire reveals that only four of the 10 online participants had no contact outside of GroupShare. Even amongst groups who had regular face-to-face contact, GroupShare was used extensively and there were numerous responses indicating that the participation awareness mechanism was appreciated. The response to the participation awareness mechanism amongst online participants was not substantially different from the overall response, nor was the sample size large enough to make reliable generalisations. Hence, while the potential for inaccuracy is obviously lessened in groups with no face-to-face contact, in this research sample there is no evidence that it is a determining factor in the effectiveness of or response to participation awareness.

As with the issue of qualitative metrics, the issue of unrecognised face-to-face and out-of-system activity cannot realistically be ‘solved’ through technology in a generically applicable and reliable manner. Therefore, the author feels that the optimal solution again relies upon ensuring that users are educated as to the nature and limitations of participation awareness. Information available to users must emphasise the fact that only activity occurring within the groupware environment can be utilised as a metric. Furthermore, it is important not to penalise, highlight or imply judgement of users who are under-represented in the participation awareness mechanism. The need for this is emphasised by Participant 28, who stated that the mechanism could “make members feel bad about them selves if PA doesn't show that he/she has given much participation when actually he/she has participated in non-online ways.”

participants expressed that they would be concerned if a participation awareness mechanism was as a basis for assessment within their unit. This concern was based upon the potential for inaccuracy due to the quantitative metrics and the inability to accommodate for face-to-face activity. Hence, it is also important to clearly specify if and how a participation mechanism will influence any form of assessment. The current research indicates that most users understand and accept that the mechanism is unable assess the quality of contributions or accommodate for activity outside of the groupware environment. If the guidelines regarding documentation of the mechanism are adhered to, users can be encouraged to perceive and interpret the mechanism in the most suitable manner.

## **7.2 Supporting Question 1**

*What are the key metrics and processes required to autonomously measure participation in online group work?*

The metrics of participation awareness encompass three distinct elements – the actions which are captured, the points assigned to them to represent their relative values, and the limits assigned to them to deter spam, noise and gaming. Each of these elements will be addressed in this sub-section and discuss the process of defining the metrics of participation awareness in a generic groupware environment.

The actions which are available and desirable as participation awareness metrics are dependent on the groupware environment and the context of the group work, thus making a complete list of actions impossible and irrelevant. Hence, the author defined two tenets in order to guide the definition of participation awareness metrics:

- Any action that can be captured in the groupware environment is a potential participation awareness metric.
- Any action that can be seen to be indicative of participation should be a participation awareness metric.

Most groupware environments will allow for a range of generic actions that may be utilised as metrics. Common generic actions include logging in and out, viewing areas

of the environment, submitting content, commenting on or otherwise interacting with submitted content, and utilising communicative tools such as discussion forums, live chat and private messaging. Whether or not an action is utilised in the participation awareness metrics is dependent on the context of the group work. If an action has no possible bearing on user participation, then there is no need to include it as a metric. Other potential metrics could be eliminated from the metrics model for various reasons such as relevance or reliability. The groupware environment and context of the group work may make further actions available for use as participation awareness metrics, and due to their situational nature, these may be of high value or importance to the mechanism. Examples of such actions include participation in an online meeting or drawing board, the submission of a progress report, or the completion of a multiple-choice test. Once the desired metrics have been defined, points must be assigned to them in order to reflect their relative value.

This research established a method of depicting the value of actions by assigning them Contribution, Communication and Activity points, described in Section 3.6.2 and Baatard (2007a). This built upon the method established in prior research by the author (Baatard, 2006), which utilised categories of Contribution, Participation and Activity in a similar manner. The intent of both methods was to reflect the weight of different actions with as much precision as possible, and to ensure that passive and transparent actions could be appropriately recorded. As described by Borges and Pino (1999), actions such as viewing a piece of submitted work may be of value and indicate participation, despite not contributing directly or being noticeable by other group members. Hence, these actions are important participation awareness metrics and must be captured in a suitable manner. The categories of Contribution, Communication and Activity allow points to be awarded for actions considered 'core contribution', as well as supporting and passive actions.

Via log-based observation, the author noted that participants were universally awarded a greater number of Activity points than Contribution and Communication points (unit summary diagrams, Chapter 5). This is a result of all actions being awarded Activity points, while only some actions received points in the Contribution or Communication categories. Contribution and Communication points were typically

awarded in similar amounts (unit summary diagrams, Chapter 5). As with the actions themselves, appropriate point values and categories depend upon the groupware environment and the context of the group work. While a universally generic method cannot be prescribed, the author feels that the Contribution, Communication and Activity method designed and utilised in this research was appropriate and successful, and would be applicable to most instances of a participation awareness mechanism. Regardless of the categories and values that are used, the primary goals of the metrics of participation awareness are to reflect the relative value of actions, and to ensure that passive and transparent actions are accounted for.

The final element of participation awareness metrics is that of limits. While users are able to perform as many actions as they desire within the groupware environment, the limits define temporal thresholds beyond which further actions do not influence the participation awareness mechanism. The aim of these limits is to deter users from generating spam, noise, or attempting to game the participation awareness mechanism in order to manipulate it in their favour. As different actions occur at different frequencies, each action has its own limit associated with it. Limits can be based on frequency over time, as well as in relation to objects within the groupware environment. For example, two logins were counted per day and two comments were counted per file per day. The limits applied in this research were drawn from the author's experience, as no research literature was found that offered guidance regarding suitable limits. Care must be taken to implement limits that still allow the mechanism to recognise a high level of participation, however lower limits could be set in order to implement an obtainable 'maximum participation rate'.

Log-based observation in this research revealed that while the limits did serve to curb excessive numbers of points from being awarded, they did not have a pronounced impact on observable trends or relative values in the mechanism. Unsurprisingly, the limits had the greatest impact on Activity points, which were awarded for all actions. The impact on Contribution and Communication points was minimal as such actions occurred less frequently. Table 7.1 illustrates the impact of the limits on the participants of this research, using the average of the final values as calculated and presented by the Complex Text presentation style with and without limits in effect.

For further illustration of the effects of limits on the participation awareness mechanism, refer to Appendix N.

Table 7.1 – Impact of limits on participation awareness mechanism (Complex Text presentation style)

Value	Average Limited Value	Average Unlimited Value	Average Difference
Contribution	289	340	11.3%
Communication	247	325	13.8%
Activity	746	1090	24.3%
Overall	1282	1754	20.3%

Points in the Complex Text Overall category, a summation of the Contribution, Communication and Activity points, were an average of 20.3% lower when limits were applied. As illustrated in Table 7.1 and Appendix N, the majority of this difference was due to limits reached by users in the Activity category, with Contribution and Communication showing a substantially lower difference. This result was consistent for low, average and high usage participants, as illustrated Table 7.2, which presents the data from an individual user perspective. While there appears to be a relationship between usage and the impact of limits in the Overall category, this is not always observable in the other categories. By limiting most on a daily basis, the evidence suggests that the limits in the participation awareness mechanism encouraged regular activity over an extended period. Hence, uneven differences between various usage levels may be due to periods of high activity within the space of a single day – where users of any usage level are likely to attain the limits of certain actions.

Table 7.2 – Impact of limits on individual participants of varying usage

<b>A. Low Usage Participant (Participant 18)</b>			
Value	Limited Value	Unlimited Value	Difference
Contribution	116	128	9.4%
Communication	27	27	0%
Activity	298	324	8%
Overall	441	479	7.9%

<b>B. Average Usage Participant (Participant 57)</b>			
Value	Limited Value	Unlimited Value	Difference
Contribution	401	425	5.6%
Communication	135	141	4.3%
Activity	749	941	20.4%
Overall	1285	1507	14.7%

<b>C. High Usage Participant (Participant 21)</b>			
Value	Limited Value	Unlimited Value	Difference
Contribution	931	1050	11.3%
Communication	727	1002	27.4%
Activity	1767	2816	37.3%
Overall	3425	4868	29.6%

Implementing limits is not an essential component of a participation awareness mechanism as its main purpose is to deter and minimise the impact of attempts to manipulate the mechanism. It is entirely possible that certain groupware environments, contexts and users would not attempt to manipulate the mechanism, and hence would not require limits. However, this research found that implementing limits had a positive impact on participant perception of the mechanism, and curbed the awarding of excessive amounts of points. As previously mentioned, it is possible to implement limits that can be reached by a reasonable amount of activity, in order to create a maximum participation rate, which may in turn minimise competition between group members.

This research utilised the metrics, values and limits listed in Table 3.6 and Table 3.7. As GroupShare offers a range of features common to most groupware environments, many aspects of the metrics were of a generic nature. The participant response to the participation awareness mechanism in GroupShare and their feedback regarding its metrics were into consideration and a revised table of participation metrics is available in Table 7.3. While direct feedback regarding the participation awareness metrics was sparse in the gathered data, it identified two areas where participants felt that points were awarded too heavily and too often:

- Passive and indirect actions, such as logging in and viewing areas of the application.
- Actions that are easy to perform in a manner which was not necessarily constructive, such as commenting on a file or replying to a thread.

In reference to the two guiding tenets of participation awareness metric definition defined earlier in this section, the two areas identified by participants can be described as a slight difference in perception between the author and participants. For the purposes of the research, the author defined a set of metrics which was 'all inclusive' and which aimed to recognise a wide range of metrics in the initial metrics model. Participants who provided feedback regarding metrics were more selective and identified some areas of the metrics model they felt were recognised and rewarded too highly and too often. While the author aimed to include all actions that had potential as metrics of participation, some participants felt that actions in the areas



described were not indicative of participation to a level that justified the amount and frequency of points that were awarded.

The point values and limits of actions in the areas identified by participants are re-evaluated in Table 7.3. Numerous actions present in Tables 3.6 and 3.7 have been removed from this table, but this does not imply that they are inappropriate as metrics. Rather, Table 7.3 aims to be concise, presenting the core generic metrics rather than a comprehensive listing of possible metrics.

Table 7.3 – Possible generic metrics

Metric Name	Metric Description & Limit	Cont. Points	Comm. Points	Act. Points
Chat Message	Sending a message in live chat <i>Maximum of 30 per day counted</i>	0	1	1
Comment	Commenting on a file <i>Maximum of 2 per file per day counted</i>	1	1	1
Download	Downloading a file <i>Maximum of 1 per file per day counted</i>	0	0	1
Forum Post	Posting a new thread in a discussion forum <i>Unlimited</i>	3	3	2
Forum Reply	Replying to a thread in a discussion forum <i>Maximum of 2 per thread per day counted</i>	1	2	1
Login	Logging in to the groupware application <i>Maximum of 2 per day counted</i>	0	0	1
Logout	Logging out of the groupware application <i>Maximum of 2 per day counted</i>	0	0	1
Post Message	Posting on a message/announcement board <i>Maximum of 3 per day counted</i>	0	3	2
Rate	Rating a file, forum thread, or other shared object <i>Maximum of 1 per item per day counted</i>	1	1	1
Read PM	Reading a private message from another user <i>Maximum of 4 per day counted</i>	0	1	1
Send PM	Sending a private message to another user <i>Maximum of 2 per day counted</i>	0	2	1
Submit	Uploading a file <i>Unlimited</i>	6	2	3
Update Profile	Updating a personal profile <i>Maximum of 1 per day counted</i>	0	2	2
View File	Viewing a file and its associated metadata <i>Maximum of 2 per file per day counted</i>	0	0	1
View Home	Viewing the home, default or main page <i>Maximum of 4 per day counted</i>	0	0	1
View Profile	Viewing another user's personal profile <i>Maximum of 2 per day counted</i>	0	0	2
View Thread	Viewing (i.e. reading) a thread in a discussion forum <i>Maximum of 2 per thread per day counted</i>	1	0	1

This table is merely a guideline to illustrate possible generic metrics of participation awareness, and should not be considered prescriptive. Furthermore, it should be noted that the current scale or granularity of the values is in no way fixed. Greater

precision could be achieved by introducing half-points, or increasing the scale of points.

Although the values and limits in Table 7.3 aim to be generic, they are based on this research and its context. If a participation awareness mechanism were to be deployed in another groupware environment in another context, these values and limits may not be appropriate. For example, if deployed in an environment where group discussion was of higher importance than the submission of files, one would expect higher values to be assigned to forum-related activities. In a generic environment such as GroupShare, different subsets of features may receive more or less usage by groups working on different tasks. Hence, it is important not to skew the points or limits applied to actions in the environment towards any particular subset of features. In the current research, more points were awarded for submitting a file than for the posting of a new thread in the discussion forum, however this was balanced by the relative effort typically required to perform each action, and the potential for further points to be awarded for the posting of replies to a discussion thread. As discussed in Section 5.4, groups which utilised different subsets of features did not exhibit a noticeably different response to the participation awareness mechanism or its accuracy, suggesting that the metrics were suitably balanced and remained effective in spite of feature usage. The balance of points and limits across different actions may be an issue of less importance in groupware environments that are designed to support a specific task or form of group work.

Once the range of actions and associated values and limits have been defined, the mechanics to capture and represent this in the groupware environment must be implemented. Discussion of this falls outside the scope of the current research, but as most actions are routinely recorded as logs, implementing the capture of participation awareness metrics is unlikely to be overly complex or have an impact on application performance. The algorithms that implement the values and limits upon actions are likely to be of moderate complexity, but did not appear to degrade groupware performance in the current research, even when processing the logs of nearly 100 000 actions. When users have been exposed to the participation awareness mechanism for a substantial period of time, it may be worthwhile to seek feedback from users

regarding the actions, values and limits used as metrics. This feedback can be used to further refine the participation awareness metrics, increasing its perceived accuracy and relevance to users. This research demonstrates such a practice, where the feedback of users was utilised to refine the generic metrics model presented in Table 7.3. It may also be worthwhile to implement a front-end interface that allows participation awareness metrics to be adjusted efficiently by system administrators, teaching staff or management personnel. This is discussed further in Section 7.6.

In conclusion, the metrics required to autonomously measure individual participation in online group work fall into three key areas: the actions that are captured; the assignment of points to the actions in order to reflect their relative value; and application of limits to deter spam, noise and gaming. By investigating these metrics in a generic groupware environment, the research was able to produce and refine an implementation of a generically applicable metrics model. The Contribution, Communication and Activity framework used to indicate the value of actions is of a generic nature, and limits are applied to metrics based on time and action type. While a table of possible generic metrics has been presented, the contextual nature of participation awareness cannot be understated. Table 7.3 is an example based upon the context of this research and the author's prior research (Baatard, 2006) in the area. The procedures and concepts discussed in this section define the metrics of a participation awareness model.

### **7.3 Supporting Question 2**

*How can participation awareness be presented in a groupware interface such that it is deemed effective by those making use of it?*

While the research initially aimed to discover a single optimal presentation style for participation awareness, feedback from participants made it clear that having multiple styles available was a preferable approach. Different participants expressed preferences for different styles, with multiple participants also stating they regularly used a range of presentation styles. The reasons given varied, with participants reporting that certain presentation styles better suited their working style, were more

visually appealing, or provided specific information that they desired. Overall, the two simple styles were found to be more effective and preferred by a greater number of participants. This result emphasises the need for the mechanism to provide information at-a-glance, a need expressed in Steinfield, Jang and Pfaff (1999) and Benford, Bowers, Fahlén, Marian and Rodden (1994). The provision of information at-a-glance minimises the cognitive effort required for users to absorb awareness information. The importance of at-a-glance awareness information was further emphasised by open-ended comments from participants such as “complex text isn’t very natural to take in” (Participant 60), “I think the 2 complex styles are a little too complex for normal use” (Participant 55) and “the complex ones were a bit difficult to view at a glance” (Participant 23). While the complex styles were deemed less effective in terms of providing at-a-glance information, they were effective in providing deeper and more sophisticated information, which was appreciated and used by numerous participants. For example, Participant 28 stated “The complex text was probably most used because it puts it into a better perspective” and Participant 11 stated “As a technically minded person, I generally prefer list/text-based output with some minimal graphics such as the UP/DOWN/NEUTRAL icons for Complex Text layout.”

Three archetypes of participation awareness presentation styles have been defined. These are based on recommendations from literature and the results of this research. The first presentation style archetype is dubbed ‘Statistical Style’ (Figure 7.1) and is based on the Simple Text style defined in the current research. This style also incorporates the findings of Baatard (2006), in which participants felt that too much abstraction and processing made participation awareness difficult to interpret. This style presents participation awareness as a series of statistics and does not include the weightings and limits applied to the metrics. By presenting data as raw statistics the potential for ambiguity is minimised and users are encouraged to recognise the objective nature of the mechanism. While the statistics presented in this style may vary between groupware environments and contexts, they should focus on key collaborative, communicative and participative actions. Ideally, the statistics should expose information that would otherwise remain hidden from participants, such as viewing the work of others in a timely manner.

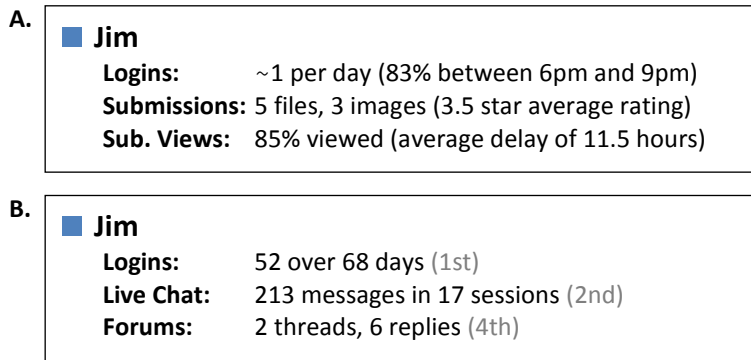


Figure 7.1 – Two sample implementations of participation awareness in Statistical Style (single user shown)

The second presentation style archetype is based on the Simple Graphics style of the current research. Dubbed ‘Graphical Style’ (Figure 7.2), this style presents participation awareness in an easy to interpret graphical manner, such as one or more pie charts or bar graphs. This style takes the values and limits of the metrics into account, processing all actions to provide a visual representation of participation. The Simple Graphics style used in the current research was the most preferred overall by participants, who reported in the open-ended responses that they appreciated its at-a-glance nature. Again, the content of the style cannot be generically dictated, but is likely to depict key areas of collaboration, communication and participation. In the current research, the Simple Graphics style used pie charts to depict general activity, file activity and forum activity. This direct relation to actions within GroupShare made the style fairly unabstracted. However, it is possible to make a Graphical Style represent abstract data such as contribution or communication. The findings of this research suggest that the Graphical Style should be the default style in a participation awareness mechanism. If a participation awareness mechanism employs a single presentation style, this research indicates that the Graphical Style is the most effective, especially when supplemented with some statistical data.

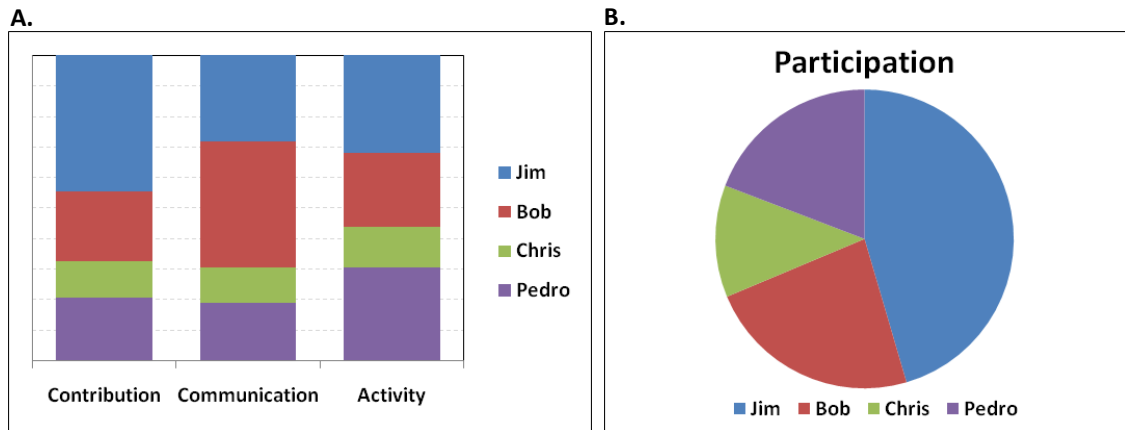
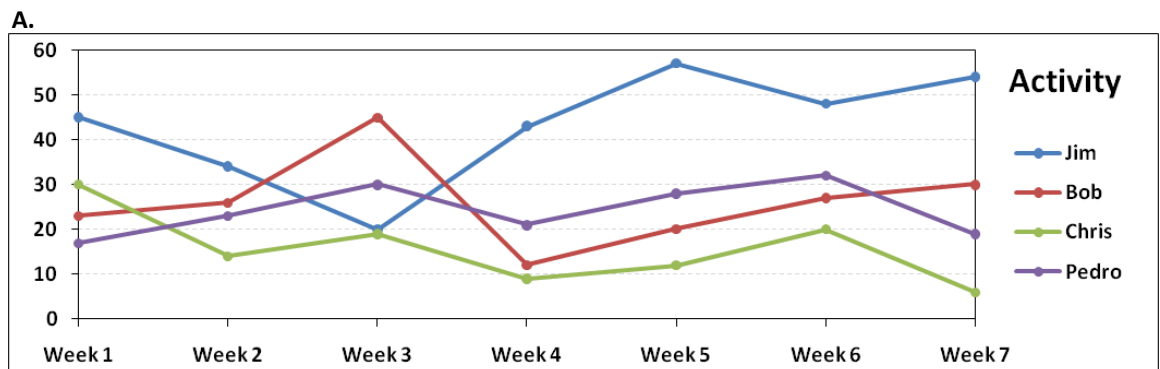


Figure 7.2 – Two sample implementations of participation awareness in Graphical Style

The final presentation style archetype is based on an amalgamation of the Complex Text and Complex Graphics styles of the current research, and is named ‘Detailed Style’ (Figure 7.3). This style sacrifices some of the mechanism’s at-a-glance nature in order to provide more sophisticated and complex information. While the complex styles were not as popular amongst participants as the simple styles, they did receive use and were appreciated by some of the research participants. Some participants stated in their open-ended responses that they used a complex style most of the time, while others switched to them temporarily in order to meet a need for certain information. The presentation of this style is variable and could be implemented in a textual or graphical manner, so long as the information it provides is more sophisticated and complex than that offered by the other styles. The author feels that it is also important for this style to incorporate the element of time or some form of progression, for example by comparing daily values or depicting a graph over time. In order to achieve an optimal balance of sophisticated information and at-a-glance readability, the author recommends a graphical format for this presentation style.



B.	Contribution		Communication		Activity		Overall	
	Total	Today	Total	Today	Total	Today	Total	Today
<b>Jim</b>	89	7	162	12	351	46	602	65
vs. group average	+113%	+133%	+39%	+20%	+28%	+63%	+39%	+61%
<b>Bob</b>	42	2	154	15	386	24	582	41
vs. group average	+1%	-33%	+32%	+50%	+41%	-15%	+35%	+2%
<b>Chris</b>	12	0	65	4	121	14	198	16
vs. group average	-71%	-100%	-44%	-60%	-56%	-50%	-54%	-60%
<b>Pedro</b>	24	3	85	9	238	29	347	39
vs. group average	-43%	0%	-27%	-10%	-13%	+3%	-20%	-3%

Figure 7.3 – Two sample implementations of participation awareness in Detailed Style

Numerous participants stated that the participation awareness mechanism was useful in a general manner as it made the existence of group member activity, or a lack thereof, readily apparent, even if the participant felt the mechanism was inaccurate. Examples of this include the following responses from the post-usage questionnaire:

“[the participation awareness mechanism lets you] see how much you and your team members are participating and who should be doing extra work or putting in extra effort” (Participant 32)

“It was good to know that group members had at least visited the site in between meetings and postings. It gave a sense of who was involved and who was not” (Participant 40)

Responses such as these suggest the potential for a simplified form of participation awareness that places less emphasis upon the use of sophisticated metrics and presentation, and instead presents a general indication of the level of recent group member activity. Such a mechanism could be described as showing the ‘pulse’ of group members. This could be implemented as an extension of participation awareness, or an independent mechanism.

Regardless of the presentation style, the author feels a participation awareness mechanism is best placed in a prominent location within the groupware environment. While it should not distract from the task-oriented focal points of the environment, positioning the mechanism on the initial or default section of the interface allows the awareness information to be absorbed without users needing to seek it out. A further option recommended by the author is the ability for users to disable the display of participation awareness in the groupware environment. While this was not an option

in the current research, a number of participants in the current and previous research suggested that it should be possible (Baatard, 2006). Whether for aesthetic, ideological or other reasons, users should be able to choose their presentation style and disable the mechanism at will. Disabling the participation awareness mechanism should have no impact on other users. It does not provide the facility to 'opt out', as users who disable the display of the mechanism still appear in their group members' displays. In regards to the elements of awareness information delivery described in Steinfield, Jang and Pfaff (1999, pp. 84-85) and discussed in Section 2.3, the author feels that a participation awareness mechanism should be passively delivered, undifferentiated between users, and fixed rather than customisable (not including the changing of presentation style). The cumulative and aggregated nature of participation awareness minimises the potential for information overload or irrelevant information. While the participation awareness mechanism is focal rather than peripheral, it is presented in a manner that can be rapidly interpreted, adhering to the "seeing at a glance" principle recommended by Benford, Bowers, Fahlén, Marian and Rodden (1994, pp. 654-655). The issues of application scope and accessibility discussed by Steinfield, Jang and Pfaff (1999, pp. 84-85) are dependent on the characteristics of the groupware environment in which the mechanism is implemented.

In this research, information about the participation awareness mechanism was available in GroupShare, including a description of each presentation style and a glossary of terms related to participation awareness. As discussed in Section 7.1.2 and Section 7.1.3, providing information that details what the participation awareness mechanism is, how it works, and its limitations, is of high importance. In particular, this documentation should state the quantitative and autonomous nature of the mechanism and acknowledge the fact that it does not recognise actions conducted outside the groupware environment. It is also important not to cast or imply judgement of users who are under-represented in the mechanism, and to declare if and how the mechanism will play a role in any form of assessment. While the current research indicates that many users will not read the information available (Table 4.105), providing easy-to-access information about the mechanism can assist in ensuring that users are aware of its capabilities and perceive it in a beneficial manner.



## **7.4 Primary Research Question**

*What are the constituents of a generically applicable model of participation awareness for online groupware systems?*

In addressing the two supporting questions, the primary research question has been explored in depth. The constituents of a model of participation awareness were examined, focusing on the two key aspects of metrics and presentation. As the previous sections of this chapter have discussed these findings in depth, this section will provide a summary and present the model of participation awareness diagrammatically.

The metrics of participation awareness were investigated through the first supporting question, drawing data from participant feedback in questionnaires and interviews, as well as from log-based observation. Three elements of participation awareness metrics were detailed. Firstly, the actions occurring within the groupware environment that are deemed to be indicative of participation were defined. While a number of generic actions are likely to exist in most groupware environments, numerous actions of high relevance are likely to be specific to the environment and context of the group work. Secondly, the actions are weighted by assigning points to them in order to reflect their relative value. This research found a method of assigning Contribution, Communication and Activity points to actions was successful in portraying the value of actions accurately and ensuring that passive and transparent actions were appropriately represented. Finally, limits were applied to the actions to impose thresholds above which further actions will not influence the participation awareness mechanism. Limits can be based on frequency over time and/or objects within the groupware environment and exist to deter manipulation of the participation awareness mechanism via spam, noise and gaming. Although not explored in this research, limits with low thresholds could be implemented in order to create an attainable 'maximum participation rate'.

The presentation of participation awareness was investigated in the second supporting question, also extrapolating data from all sources. The research established that users appreciated and utilised multiple styles of presentation in order to meet their

preferences and information needs. Three archetypes of participation awareness presentation were defined. Statistical Style presents participation awareness as a set of statistics related to participation and activity in the groupware environment. Data is presented in an unabstracted manner, minimising potential ambiguity and emphasising the quantitative nature of the mechanism. Graphical Style presents participation awareness in a simple graphical manner, such as pie charts. This style provides information at-a-glance, and can depict either direct activity in the groupware environment or abstract concepts such as contribution, communication. The final presentation archetype is Detailed Style, which offers more sophisticated and complex information. This style can be presented graphically or textually, and should incorporate the element of time. Users should also be able to disable the participation awareness mechanism, thus preventing it from being displayed in their groupware interface. This does not affect the appearance of their participation activity in the interfaces of other group members.

Throughout the research, two issues regarding the limitations of the participation awareness mechanism were reported by both student participants and teaching staff. The first of these concerned its quantitative nature, since the mechanism cannot assess the quality of actions in an autonomous manner. Doing so in a generically applicable manner is currently unfeasible, and methods requiring users to provide information concerning the quality of actions are unreliable and potentially problematic. The second issue concerned the lack of recognition of actions and activities that occurred outside the groupware environment, such as face-to-face collaboration and the use of alternate communications software. While both these issues have the potential to skew the accuracy and perceived usefulness of a participation awareness mechanism, most participants in this research appeared to accept the limitations and still find the mechanism beneficial. Since technical solutions to these limitations are not feasible, the author feels that they should be addressed via informed user perception. Documentation regarding any implementation of a participation awareness mechanism should be readily available in the groupware environment and detail what the mechanism is, how it works, and its limitations. Care should be taken not to imply judgement of users who are under-represented in a

participation awareness mechanism and any use of the mechanism for the purposes of assessment should be made clear in the documentation.

In discussing the constituents of participation awareness, it has become apparent that there are not many elements of the model which can be explicitly prescribed if it is to remain generically applicable. Rather than being a flaw in the research or the concept of participation awareness, this is an unavoidable consequence of developing a generically applicable model for a mechanism to be employed in the diverse area of groupware. This research has defined and detailed the concepts, procedures and issues which must be considered in order to implement a participation awareness mechanism. In addition, the distinct participation awareness metrics and presentation styles developed, utilised and refined in this research have been presented. Although these are bound to the context of the current research, they were investigated within a generic groupware environment and hence may be of use as examples or frameworks for the implementation of similar participation awareness mechanisms.

#### **7.4.1 Participation Awareness Model**

This sub-section presents a generically applicable model of participation awareness in a diagram (Figure 7.4). The diagram summarises the constituents of participation awareness and the steps required to implement it as an awareness mechanism. Details are omitted to simplify the diagram and keep it concise.

## Participation Awareness

*The goal of a participation awareness mechanism is to provide users of a groupware environment with a persistent and aggregated overview of group member participation, both direct and indirect.*

### 1. Metrics

*This encompasses the autonomously capturable actions in a groupware environment that may indicate participation, and the methods used to process these into useful awareness information.*

- a. Define and capture **actions** that depict participation
- b. Define and implement **values** to weigh actions
- c. Define and implement **limits** to deter manipulation (not mandatory)

### 2. Presentation

*This involves designing and implementing effective ways in which to present participation awareness, to maximise its usefulness to users, and supporting documentation available to users.*

- a. Design and implement effective **presentation styles** based on the **statistical, graphical** and **detailed** archetypes
- b. Write **supporting documentation** and make it available to users

Figure 7.4 – Participation awareness model

While this chapter presents a table of common actions and associated values and limits (Table 7.3) and depictions of possible presentation styles (Section 7.3), the model is designed to be generically applicable. The metrics and presentation of participation awareness are dependent on the groupware environment and group work in question. By following the steps presented in the model and drawing from the examples and further information in this chapter as necessary, participation awareness can be implemented in any suitable context.

## ***7.5 Investigation of Recent High Relevance Literature***

A re-examination of recent literature upon completion of the research discovered two pieces of highly relevant research. Both concern the visualisation of user participation and activity within CSCL environments and are based upon theoretical frameworks very similar to the one developed for this research. Both studies recognise the importance of peer and collaborative learning in online environments and the role that awareness mechanisms play in supporting this. The author has chosen to discuss these

two pieces of research in this section in order to examine areas of similarity and distinction between them and the model of participation awareness presented in the previous sections. This serves to highlight the relevance of the current research in the context of other modern research studies in the area.

Laffey, Hong, Galyen, Goggins and Amelung (2009) introduce the Context-Aware Activity Notification System (CANS), which monitors and records activity in an OLE and presents it to users in a customisable and context-sensitive manner. The development of CANS progressed through three distinct forms, with the primary objective being to “provide awareness information that is easy to use and supports activity awareness in online environments” (p. 171). The activity recorded by CANS includes “when a member logs in, reads a discussion board item, uploads a document, or enters a chat message” (p. 171). All of these activities are listed in Table 7.3 as generic metrics that can be used for participation awareness. Similar to this research, the inclusion of passive and transparent activities such as reading a discussion board item and logging in, Laffey et al. recognise the importance of indirect participation.

CANS first took the form of a daily “e-mail digest”, which provided “lists activity in the discussion board, resources (file sharing) and chat room” (p. 172) . Testing revealed that this approach was prone to information overload when there was substantial activity in the OLE. While some students skimmed the e-mail for relevant information, others used the length of the digest as a prompt to enter the OLE when there was a high level of activity. E-mail digests were suggested as a new feature in GroupShare by some participants of this research. If implemented into GroupShare, the author feels that the relevance of information would be maximised and the potential for information overload would be minimised due to being group-based rather than encompassing a whole class.

From usability testing, we found that as the number of activities increased, members opted for visual representations of notification information as the most useful and effective when compared to the textual formats used in the current digests. (Laffey et al., 2009, p. 172)

The second form of CANS was an interactive Web page, and was closely related to the participation awareness mechanism implemented in GroupShare. Utilising a combination of textual and graphical information, the interactive Web page allowed members of the class to “see and compare individual student activities in class”, recognising the “many and varied ways they like to use the social information” by offering interactivity and customisability (p. 172). The mechanism, illustrated in Figure 7.5, incorporated numerous elements also apparent in participation awareness, including the comparison of individual user activity and the categorisation of different types of activity. The mechanism also included activity awareness in a form similar to that used in GroupShare, and allows for the customisation of which activities are listed and the timeframe.

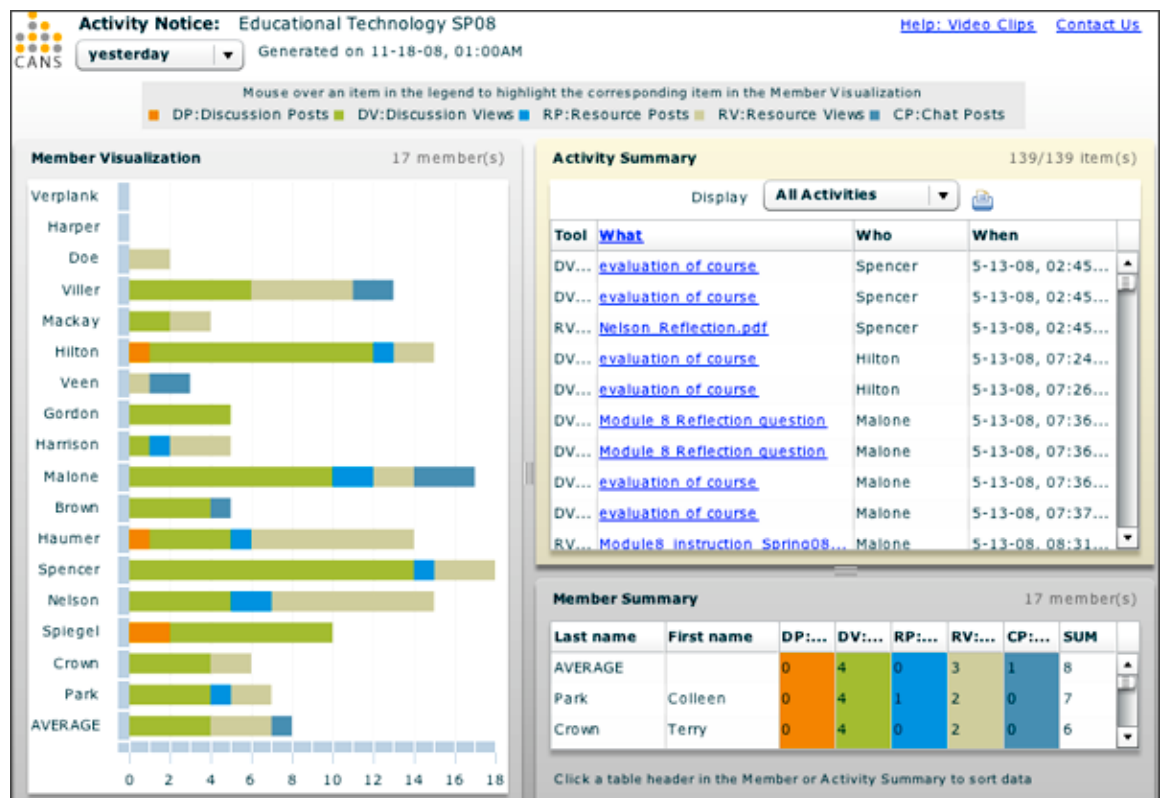


Figure 7.5 – The Context-Aware Activity Notification System (CANS) in the form of an interactive Web page

The interactive Web page form of CANS was tested in two online courses in 2008, receiving a range of responses from students:

Many were often worried about how it would be interpreted or used by the instructors or peers, and if the quality or thoughtfulness of their postings would be taken into account. .... The Member Visualization also had different effects on people depending on their motivations. For some students, the visualization had no effect; to others it made them feel competitive to “get the longest bar graph”, while others wanted to seem average and not look like they “didn’t have a life” and therefore logged out early without reading everything they wanted. (Laffey et al., 2009, p. 172)

Almost all of the issues raised in these responses were evident in the current research and have been discussed in previous sections. Teaching staff found the interactive Web page useful for identifying non-participation and gaining an overview of a student’s history in the class when needed. Most students felt that the mechanism in this form was too intrusive. The author of the current research feels that the intrusiveness of such a mechanism would be minimised if implemented in a group-based environment, where the activity of group members is of direct concern and relevance to users.

In response to the intrusiveness of the interactive Web page, the third and current form of CANS is that of a “Homepage Widget”, presented on a per-user basis in a private area of the OLE (Laffey et al., 2009, p. 173). Rather than providing activity information for all users, bar graphs of activity are presented for the current user, the class average and the most active ten percent of the class. As a more personalised approach, this form of CANS allows for meaningful generalised comparison with others, while minimising intrusiveness. Testing is still underway for this form of CANS. In summarising the implications and future of CANS, Laffey et al. state that better support for students working in groups is a goal of further design efforts.

The second piece of highly relevant literature is by Janssen, Erkens, Kanselaar and Jaspers (2007), and investigates the effects of a visualisation of participation in a CSCL environment. While a visualisation of participation is nominally the same as a participation awareness mechanism, the term ‘visualisation of participation’ is used in this discussion to avoid confusion with the participation awareness mechanism of the current research. Janssen et al. hypothesised that a visualisation of participation could contribute to successful CSCL. The basis and theoretical framework for their research is almost identical to this research. It recognises the influence of constructivist-based

pedagogies and collaborative learning and the increasing use of information and communication technologies (ICT) in education, which lead to the concept of CSCL and the need for mechanisms to support effective online collaboration. Janssen et al. propose the visualisation of participation as a method of improving participation in CSCL, one of the potential benefits of participation awareness recognised in this research. “It can be hypothesized that visualization of participation affects participation through *motivational* and *feedback* processes” (Janssen et al., 2007, p. 1040). By visualising participation, a link is established between a group member and their contribution, potentially providing an incentive or motivation to participate. This can be realised via social evaluation or comparison, for example by encouraging participation in order to meet the group's standards or by making a lack of participation more noticeable. A visualisation of participation also serves as a form of external feedback and facilitates group cohesion, allowing groups to reflect upon and evaluate their performance and progress in a collaborative task. “For example, after examining the visualization, a group member may feel someone is free riding, which may stimulate him or her to discuss this with other group members by referring to the visualization” (p. 1040). This exact process was described in the interview with Participant 21, in Section 6.3.2.

The visualisation of participation in Janssen et al. was named the ‘Participation Tool’ (PT). Since Janssen et al. sought to evaluate the impact of this awareness mechanism, their study was more experimental than this research. Utilising a posttest-only design, a treatment group of 52 students used a groupware environment including the PT to complete a collaborative project, while a control group of 17 students used the same environment without the PT. Students were randomly assigned into teams of three or four in order to complete the project. The groupware environment used was Virtual Collaborative Research Institute (VCRI. Jaspers, Broeken, & Erkens, 2005), “a groupware program designed to support collaborative learning on research projects and inquiry tasks” (Janssen et al., 2007, p. 1044). It is pictured in Figure 7.6, with the PT visible in the lower left corner.



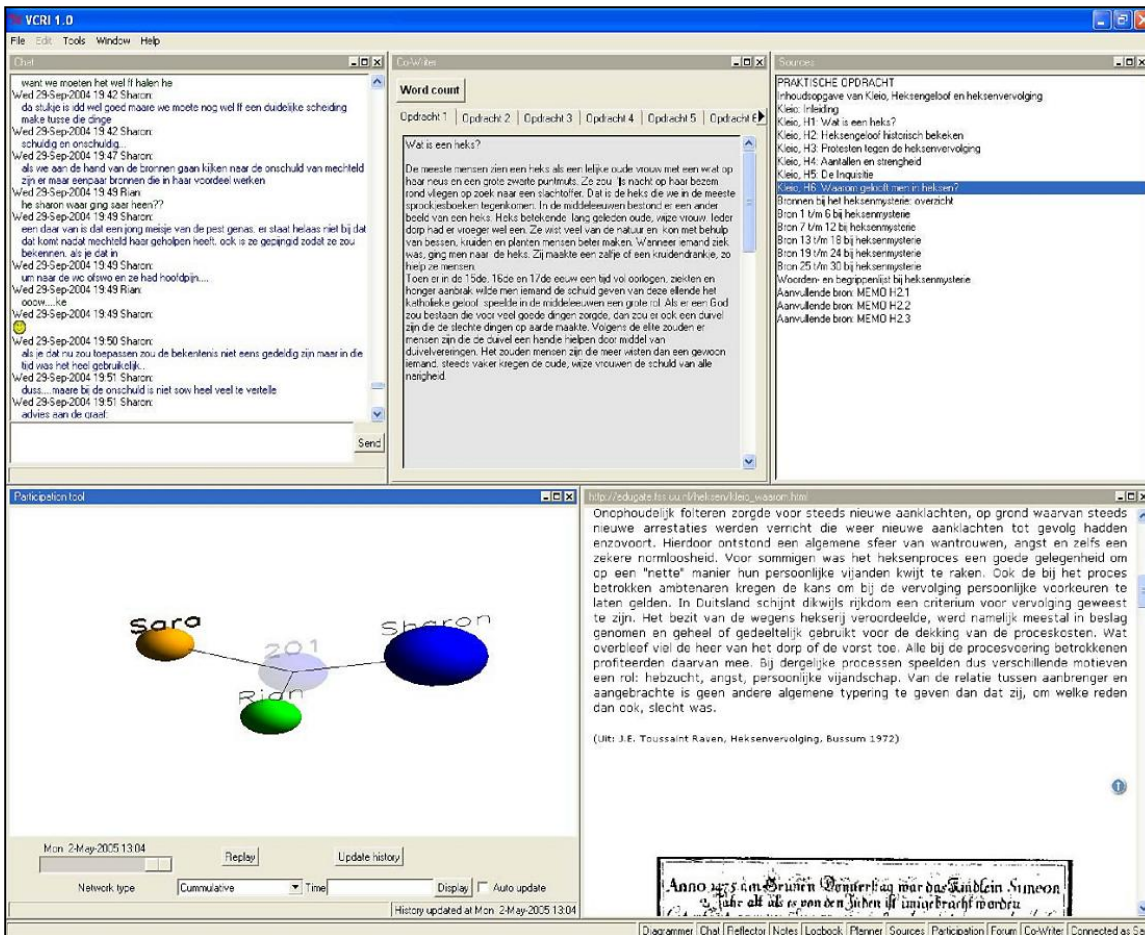


Figure 7.6 – Virtual Collaborative Research Institute (VCRI), with the Participation Tool in the lower left corner

The PT in VCRI aims to visually represent the communication-related participation of each member in a group. The tool's metrics are limited to the number and average length of message sent in the application's synchronous chat feature. Participation in other areas of the application such as a shared word processor do not influence the mechanism. Each group member is represented by a sphere connected to a central point by a line. The distance from the central point is determined by the number of chat messages sent and the size of the sphere is determined by the average length of messages. Hence, a small sphere situated far from the central point indicates a low number of short messages, while a large sphere close to the central point indicates a large number of long messages. This method of presentation bears similarities to those implemented in Chat Circles (Viegas & Donath, 1999) and Babble's social proxy (Erickson et al., 1999), discussed in Section 2.3. Janssen et al. recognise the quantitative nature of this mechanism:

The PT visualizes the quantity of the online communication between group members and the equality of participation between group members. Obviously, the quality of the messages sent by the students is also very important for successful collaboration. The PT does not visualize the quality of the messages sent by the students. (p. 1047)

Usage of the PT in the groupware environment was monitored for the purposes of the research. The mechanism could be interacted with in a number of manners, such as maximising, zooming or rotating. These interactions with the mechanism were recorded as a measure of 'usage' of the mechanism, and the total time that each student displayed the PT on their screen was also recorded. Questionnaires were used to gather data, and statistical and qualitative analysis of chat messages were used to analyse the results of the study. The key findings of the study have been summarised in the following dot points:

- While some participants used the PT very little, most participants made quite intensive use of it. "Most students displayed the PT a considerable amount of time (18%) ... and used the PT on a regular basis (about once every 5 min)" (p. 1053).
- Use of the PT correlated positively with participation equality in regards to the length of messages sent, indicating the motivational effect described earlier. The PT was found to "partly stimulate participation and equality of participation" (p. 1059).
- Analysis of questionnaire results did not find that having access to the PT increased awareness of group processes and activities, however participants in the treatment group reported a better awareness of non-participating group members.
- Treatment groups displayed greater social presence within their groups, resulting in slightly more effective collaboration.
- Despite the otherwise positive effects of the PT, the efficacy of collaboration and group performance of treatment groups were not significantly higher than those of the control groups.

The findings of Janssen et al. were consistent with those of other studies that have implemented visualisations of participation, such as Zumbach et al. (2004) and

Michinov and Primois (2005). Distinctions exist between the mechanisms implemented in Janssen et al. and this research. The Participation Tool is of a much narrower scope than the concept of participation awareness, with a metrics model that only makes use of the number and average length of chat messages. The metrics of participation awareness incorporate a wide range of actions, which are categorised, weighted and limited. As such, some points of comparison are not valid. For example in Janssen et al., participants did not report an increased awareness of group processes and activities. While this is understandable for a mechanism which incorporates chat-related metrics alone, it is not appropriate to generalise this to the likely outcomes of a more sophisticated mechanism such as participation awareness.

Janssen et al. (2007) and Laffey et al. (2009) both present visualisations of participation in groupware-supported CSCL environments which are based upon the belief that doing so will increase the effectiveness of online collaboration. Such a goal is multi-faceted, with effects upon participation, cohesion, awareness and social presence all being potential contributors to effective online collaboration. These studies are based on sound theoretical frameworks, which are akin to the framework of this research. Janssen et al., and to a lesser extent Laffey et al. focus upon examining the impact that their visualisations of participation have upon learners in a CSCL environment. Their findings have been positive, providing further justification and validity to this research study's aim to develop a model of participation awareness. Research studies such as Janssen et al. and Laffey et al. indicate the relevance and importance of the current research.

## ***7.6 Implications for Practice and Further Research***

This research focused on creating and refining a generically applicable model of participation awareness, rather than evaluating its impact upon groupware users. While the reception the mechanism received was investigated, this was in order to determine the appropriateness of the metrics and presentation styles, rather than exploring the impact upon participant satisfaction, performance or learning outcomes. Section 7.5 examined two pieces of literature which implemented visualisations of participation similar to a participation awareness mechanism and investigated their

impacts. Both studies found their respective visualisations of participation had positive impacts on several aspects of online collaboration. Similarly, the data gathered in this research suggested positive impacts of participation awareness in multiple areas, with a number of participants claiming that the mechanism made their group work more effective and easy to manage. Some students, particularly those in online groups, felt that the mechanism (and GroupShare itself) helped to foster a sense of community amongst group members and reduced the isolation of studying in an online environment. A sense of community in an online environment has been found to potentially improve educational outcomes and learner satisfaction, and reduce attrition rates (Bruckman, 2006; S. C. Hughes et al., 2002; Mayadas et al., 2009; Stacey, 2000). While the research typically discusses the benefits listed as potential consequences of establishing a sense of community, social presence and working collaboratively, the impact of participation awareness on such factors is worthy of further research.

Many participants also mentioned that the participation awareness mechanism had an impact on the level of activity that they and their group members displayed in GroupShare. Prominently depicting participation encouraged participants to use GroupShare more frequently and to sustain their activity over a longer period. Regular exploration of the environment and communication with group members was recognised and rewarded by the mechanism. While some participants felt that this increased activity was constructive, there were some reports of group members creating spam and noise. Some participants felt that the mechanism made group work more competitive and increased the pressure to participate. Again, some participants found this to have a positive impact, while others felt it had a negative impact. The author feels that although a percentage of users may attempt to deceive or manipulate the mechanism, encouraging activity in the groupware environment is beneficial overall and helps to foster a sense of community and social presence which contributes towards effective group work. Participation awareness also has the potential to reduce the likelihood of 'lurkers' or 'freeloaders' in online collaboration by making a lack of participation more noticeable (F. Chen, 2004; Gerbic, 2006; Janssen et al., 2007; Salmon, 2006). Further research into the impact of participation awareness is recommended, in order to discover ways in which its benefits can be maximised and

any potential negative impacts can be avoided or minimised. Research into the effect of implementing low thresholds to the limits applied to participation awareness metrics is also suggested. The author theorises that creating an attainable maximum participation rate could minimise the increased feelings of pressure and competitiveness some participants felt the mechanism caused.

The effectiveness and perceived accuracy of a participation awareness mechanism could also be improved via further research regarding qualitative metrics. While discussion in Section 7.1.2 concluded that no generically applicable and autonomous qualitative metrics appear feasible at this stage, avenues of further research have been identified. As previously discussed, a labelling feature could provide a means for users to express the perceived quality of contributions in a more meaningful and relevant manner, giving it higher potential as a qualitative metric than a rating feature. Some participants remarked that inane comments in response to contributions were awarded too many points by the participation awareness mechanism. While complex analysis of comments to determine their relevance and constructiveness is beyond the scope of a participation awareness model and is unlikely to be generically applicable, the length of comments may have potential as a qualitative metric. While an extremely short comment may be relevant, is not likely to be deep or constructive. Hence, comment length may be used as a modifier to the points awarded by a participation awareness mechanism for making the comment. A labelling feature and comment length are two examples of possible qualitative metrics and elements which could refine participation awareness with further research.

In the interview with Participant 21 and Student 1, the use of participation awareness as a tool for participation monitoring and early intervention was discussed. As the leader of his group, Participant 21 noticed a group member was underperforming according to the participation awareness mechanism in GroupShare. This prompted him to contact the group member and then use the mechanism to monitor the response to his intervention. Participant 21 felt that the mechanism allowed the lower participation to be noticed early and dealt with effectively. Teaching staff were able to view the participation awareness mechanisms of groups in their participating units, and while this was not heavily used, it further explores the potential of participation

awareness as a tool for group leaders or coordinators. An awareness mechanism intended for group coordinators was proposed in Borges and Pino (1999) and intended to provide them with the information required to notice and respond to issues within groups. Further research and development of this aspect of participation awareness could serve to expand its value.

In relation to increasing the value of the participation mechanism for group leaders and coordinators, the possibility of a metrics management interface was discussed. Available to group leaders and coordinators, such an interface would allow the participation awareness metrics to be tailored and tweaked as desired. Hence, group leaders and coordinators could ensure that the metrics driving the participation awareness mechanism were relevant to the group in question and emphasise actions of high importance. A component of research into this area should involve the granularity of the interface and determine if it should allow each metric, value and limit to be changed, or if more abstract concepts such as 'communication' and 'file-related actions' could be utilised for ease of use.

During the research, the possibility of using participation awareness as a basis for the assessment of individual participation in group work arose. Since the mechanism is unable to assess the quality of contributions or recognise activity that takes place outside of the groupware environment, it cannot be considered accurate or all-encompassing enough to be the sole basis of assessment. Several participants in this research made note of this, and noted that basing an assessment entirely or heavily on the participation awareness mechanism would be cause for concern. Despite this, a participation awareness mechanism could help to assess participation in the groupware environment, in combination with knowledge of user participation. When group interaction occurs entirely within the groupware application, its potential for use in relation to assessment rises. This is recognised by Macdonald (2003, p. 378), who discussed the need for text-based communication in online group work: "a transcript of ... messages can be used to judge both the group collaborative process, and the contribution of the individual to that process." Users could also make use of a participation awareness mechanism to assist in completing a peer assessment or

review. Further research into the possibility of using participation awareness for assessment, and the affinity of users towards this, could be beneficial.

### ***7.7 Limitations of the Research***

While every effort was made to maximise the number and variety of participants, a total of 63 provided a full data set. A further 69 pre-usage and 16 post-usage questionnaires were submitted in incomplete data sets. The author feels that the sample size was suitably large and displayed a wide range of demographics, however a greater number of participants could have provided further or deeper feedback. Furthermore, while the participants' personal demographics were varied, they were all students of a single university and almost all were studying in the same school. As described in Section 3.3.2, this was a matter of suitability, feasibility and convenience. Regardless, the limited scope of participant contexts could be seen as a limitation of the research. A larger number of participants studying online, exhibiting a wider range of age groups and genders, could have resulted in further insights concerning the distinctions between face-to-face and online collaborators.

Similarly, the findings of this research may not be as applicable to or representative of group work in enterprise environments. While the composition, formation, duration and activities of the groups were of a generic nature, they were all conducted within an educational context. It is probable that groups or teams in an enterprise environment would face different challenges and issues that could influence the requirements of and reception to participation awareness. The model proposed in this research may require further examination in enterprise environments to maximise its generic applicability.

### ***7.8 Conclusion***

As universities continue to adopt constructivist-based learning strategies that emphasise the building of knowledge through interaction between peers, group work has become increasingly prominent in higher education. Coupled with the rising number of students studying online, the need to support online group work is readily

apparent. Likewise, group or team based work has been the norm in enterprise for quite some time, and given the prevalence of the Internet it is no surprise that many teams in enterprise environments collaborate wholly or partially online.

Groupware offers the sophisticated features and facilities required to collaborate effectively in an online environment and is widely employed in both education and enterprise. However, online group work often does not live up to expectations or compare favourably to face-to-face collaboration. The research literature reports the issue of awareness to be a significant factor of the effectiveness of online group work. People collaborating in an online environment are devoid of the awareness of their group members' activities that is inherent in face-to-face collaboration. While numerous awareness mechanisms have been researched and implemented into groupware applications, mechanisms which persistently aggregate and present participation information have not previously been explored in great depth.

This research developed a model of participation awareness, a form of awareness and associated groupware mechanism that aggregates and processes activity within a groupware environment. Actions performed in the environment are captured, assigned points to represent their relative value, and given limits to deter the manipulation of the mechanism. The aggregated and processed metrics are then presented in the groupware interface in a variety of textual and graphical styles, aiming to give users an overall depiction of group member participation in an at-a-glance manner. The model developed in this research outlines the generic procedures, issues and concepts that must be considered in the implementation of participation awareness in a groupware application. In order to define and refine participation awareness, a field study was conducted with university students engaged in group work. Participants utilised GroupShare, a generic groupware application developed by the author, to support their work. GroupShare featured a participation awareness mechanism and participants completed a pre-usage and post-usage questionnaire about group work and the participation awareness mechanism. Supplementary data was also gathered via student and staff interviews, a staff questionnaire and log-based observation of participants. Two iterations of the field study were conducted, each



one consisting of groups of students engaged in group work throughout some or all of a university semester.

Analysis of the data found that the participation awareness mechanism was well received by the majority of participants, as was GroupShare itself. While different units, groups and participants exhibited a variety of usage patterns, durations and profiles, the response amongst these was consistently positive. Once the appropriateness of the mechanism was established, participant feedback was then utilised to evaluate and refine the metrics and presentation styles of participation awareness, thus shaping the final model. Examples of metrics and presentation styles were produced, based on the generic implementation and context of the current research.

As presented in this chapter, the participation awareness model outlines the core constituents of participation awareness and the steps required to implement it as an awareness mechanism. The model is generically applicable, allowing participation awareness to be implemented in any groupware environment regardless of the exact software features or nature of the group work.

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## **Appendix A – Glossary of Terms**

This glossary compiles and defines the core terminology used in this thesis for quick reference. For the sake of readability, citations have been excluded in this appendix unless directly relevant to the definition of a term. Citations, and deeper discussion of the terms and related concepts, can be found throughout the thesis, primarily in Chapters 2 and 3.

### ***Academic Terminology***

As terminology differs between academic institutions, definition of the terms used in this research is beneficial. In the university in which the research was conducted, courses refer to a complete study of a discipline, resulting in a degree. These are typically made up of 24 semester-long units of topical study, which are delivered by teaching staff. Courses, units and teaching staff are further defined in their respective glossary entries.

### ***Asynchronous (Group Work)***

Asynchronous group work is group work that can be conducted without real-time (synchronous) interaction with other collaborators. Most groupware applications are designed to support asynchronous group work, allowing users to log in at any time and contribute to the group project irrespective of the presence of other group members. Group members can use or respond to the contributions of their peers, resulting in a cycle of asynchronous collaboration. Asynchronous communication is also widely used in group work, typified by e-mail and discussion forums. This form of collaboration is often referred to as being loosely-coupled – described in the glossary entry titled coupling.

### ***Awareness***

Awareness is defined in Dourish and Bellotti (1992) as “an understanding of the activities of others, which provides a context for your own activity.” In face-to-face collaboration, awareness is implicit and often taken for granted, with collaborators typically having a solid understanding of the activities of their peers, assisted by elements such as presence, attention, tone and body language. When collaborating in

an online environment, the majority of this awareness information is unavailable, and explicit effort is often needed to make presence and actions known, or to discover the presence and actions of other collaborators. Awareness is a crucial component in effective collaboration, making the inherent lack of awareness in online environments a significant issue.

### ***Awareness Mechanisms***

Awareness mechanisms are features implemented in groupware environments that aim to replace the awareness information online environments lack. Such mechanisms are varied in their specific nature, but tend to be autonomous and communicate actions which are typically transparent or unseen in an online environment. This ensures that collaborators are informed about the presence and actions of their peers, without needing to make explicit effort to discover this information.

A common awareness mechanism in asynchronous groupware is a “recent activity” display, which provides a list of recent events that have occurred in the groupware environment, making it easier for collaborators to notice actions that have occurred since they last logged in. Many awareness mechanisms are less sophisticated than this, showing simple statistics and information such as the number of times a thread has been viewed in a discussion forum. Other awareness mechanisms are more sophisticated, with some, such as participation awareness, aggregating and summarising multiple events.

### ***Contribution, Communication and Activity Points (Participation Awareness / Metrics)***

Contribution, Communication and Activity points are an element of the metrics of participation awareness. Actions in a groupware environment that are utilised in participation awareness are assigned a number of points in three categories – Contribution, Communication and Activity. As detailed in Section 3.6.2 and Baatard (2007a), these categories allow for a high degree of precision, representing the relative value of an action as accurately as possible. In particular, the distinction between direct collaboration and indirect collaboration is emphasised, and transparent actions are accounted for. Points do not need to be awarded to each category if the action does not represent it.

Contribution points are only awarded to actions that directly contribute to the group project, such as submitting a file. Communication points are awarded for actions which communicate with other group members, such as providing feedback on a contribution, replying to a thread in a forum, or sending a private message. Activity points are awarded for all actions, in particular those which are often transparent – not apparent to other group members unless an explicit effort is made to advertise or seek out their occurrence. Logging in to the groupware environment and viewing a submitted file are examples of such actions.

### ***Coupling (Group Work)***

Coupling is a term used to describe the level of interdependence between collaborators. Pioneered by Salvador, Scholtz and Larson (1996), it is described as “the amount of work that one person can do before they require discussion, instruction, action, information, or consultation with another person” (Gutwin & Greenberg, 2002, p. 426). Tightly-coupled collaboration requires frequent, often synchronous, interaction with others, while loosely-coupled collaboration involves people working somewhat autonomously, requiring less frequent interaction with others.

Loosely-coupled collaboration is predominant in both education and enterprise, where the majority of group work takes place asynchronously. Tightly-coupled collaboration tends to be short term in nature, for obvious logistical reasons. This research focuses upon loosely-coupled collaboration, where participation awareness is of greater relevance. To that end, GroupShare is designed to support loosely-coupled groups.

### ***Course (Academic Terminology)***

In the university in which the research was conducted, a course refers to a complete study of a discipline, resulting in a degree. In the author’s department, most undergraduate courses take three years of full-time study, consisting of four units per semester – a total of 24 units. Postgraduate courses take between one and three years, and typically entail both units and research.

### ***Group Work***

In the context of this research, group work typically consists between three and six group members, working together over a period of between three weeks and six months. While group work of shorter durations is fairly common, an aggregated display of participation is of higher value and relevance in prolonged group work scenarios. The majority of group members have no prior experience working together, and often have not met prior to the unit in which they are participating. Group work is loosely-coupled, and usually involves tasks such as collaboratively authoring a lengthy document or completing and documenting a project. While some groups contained members who were studying purely online, most groups in the research were able to meet face-to-face at least once a week.

### ***GroupShare***

Detailed in Section 3.6.1, GroupShare is the groupware application developed by the author to house the participation awareness mechanism for the research. GroupShare is entirely Web-based, accessible through a standard Web browser with no need for plug-ins or helper applications. To strengthen the validity of the research, GroupShare was designed to be a generic and accessible groupware application, offering common features within an easy to use interface. The core collaborative mechanism of GroupShare is file sharing, which is supported by a number of communicative features such as a discussion forum, message board and live chat. GroupShare is designed to support loosely-coupled collaboration, with the majority of features being tailored towards asynchronous group work.

GroupShare features a number of awareness mechanisms, most of which have been established in prior research and existing groupware. These include a display of recent activity within the application and statistics regarding user interaction with submitted files. The participation awareness mechanism, the focus of this research, is positioned on the primary page of GroupShare.

### ***Groupware***

Groupware is the term given to software which aims to facilitate group-based collaborative work in both educational and enterprise environments. Groupware is

typically deployed over a computer network, often the Internet, with the application being accessible from multiple locations on the network. Some definitions of groupware include technologies and software applications such as e-mail, instant messaging and discussion forums, which can be used to provide rudimentary support for group work. In this thesis, the term groupware is used to describe software that provides the communicative, collaborative and coordinative features needed to effectively facilitate online group work.

Groupware can be categorised into two primary forms, based primarily on their implementation. Enterprise-level groupware typically requires substantial infrastructure support in the form of file and database servers, middleware, and application software. This allows for sophisticated features and integration throughout an enterprise, but is typically costly, difficult to deploy, and has limited mobility. The second form of groupware exists entirely online, requiring little or no infrastructure support or locally installed software, usually requiring only an Internet browser to access. Many such applications are available online for free or at minimal cost. Whilst their features are often not as sophisticated or integrated as those of enterprise-level groupware, online groupware is typically available from any computer with an Internet connection, regardless of local software or operating systems. GroupShare is the latter type of groupware, and that which this research is focused upon. With advances in Internet-based technologies, Web-based groupware has become increasingly sophisticated, with some products aimed at enterprise-level support.

### ***Limits (Participation Awareness / Metrics)***

The various types of Groupware actions that are utilised in the metrics of the participation awareness mechanism are assigned Contribution, Communication and Activity points, to represent their relative value as accurately as possible. They are also assigned limits, which define how frequently an action can occur before further instances are ignored by the mechanism. The limits do not impact the user's ability to perform actions. Ideally, limits are set such that heavy work is recognised, but substantially greater frequencies of actions, indicative of spamming or noise, are ignored - thereby helping maintain the accuracy of the mechanism and deter

manipulation. In the current model, limits are applied based on time (e.g. two logins counted per day), with discreet objects in the environment taken into account where appropriate (e.g. two comments counted per file per day).

### ***Metrics (Participation Awareness)***

The metrics of the participation awareness mechanism refers to the capturing and processing of events which occur within the groupware environment in order to produce aggregated data concerning group member participation. This involves defining pertinent actions, assigning them values to indicate their relative importance and type and assigning them limits to deter spamming and noise. The implementation of methods to capture and process the actions is also an issue relating to participation awareness metrics. While the term metrics encapsulates all the elements listed above, it is often used in this thesis to refer to the range of recordable actions in a groupware environment. The metrics of participation awareness are the focus of the first supporting research question.

### ***Online Learning Environment***

An Online Learning Environment (OLE) is the name given to Web-based content management and delivery systems employed by academic institutions. OLEs are used to deliver course and unit content, and often provide communicative and collaborative tools to allow for interaction between and amongst learners and teaching staff. OLEs are available at any time from any place, and as such are often used to facilitate online or distance study, in which learners have little or no face-to-face contact with teaching staff or their peers. OLEs are referred to in the literature under several names, including Asynchronous Learning Networks (ALNs) and Learning Management Systems (LMSs).

While OLEs often offer some of the features and functionality of groupware, they are typically focused on the management and delivery of academic content, rather than facilitating prolonged or complex group work. Blackboard Academic Suite, named Blackboard Learn in recent versions, is the OLE used in the university in which the research was conducted.



### ***Participants, Students, Learners & Users***

Unless otherwise indicated, the following terms are defined as such. Participants refers to the 63 students who used GroupShare in the field study and provided a full data set consisting of a pre-usage questionnaire response, usage data, and a post-usage questionnaire response. As one student was active in two groups in different participating units, the number of participants in group-based analysis is 64. Students refers to all students who used GroupShare in the field study, including those who did not complete the questionnaires, or only completed one of them. Learners is a generic term referring to people engaged in higher education as a student. Users is a generic term referring to the users of a groupware application, with no specific meaning in relation to the research.

### ***Participation Awareness***

Participation awareness is the name given by the author to the type of awareness this research investigates. Participation awareness continuously aggregates a range of actions in a groupware environment, processing the data and presenting it as an overall summary of group member participation. Actions occurring in the groupware environment are given points in three categories in order to represent the relative value of an action, and can be assigned limits to deter spamming and noise. The resulting data is presentable in a range of textual and graphical styles that aim to provide an at-a-glance summary of group member participation which is informative and accurate.

### ***Presentation Styles (Participation Awareness)***

The manner in which participation awareness is presented to groupware users is the focus of the second supporting research question, and refers to the ways in which processed participation awareness data is displayed to users. In order to determine the most effective way to present the information, a number of presentation styles were implemented in GroupShare's participation awareness mechanism, each displaying it in a different manner. While in this research the term refers to the styles implemented in GroupShare's participation awareness mechanism, the term can be generically applied.

The presentation styles implemented in GroupShare were named Simple Text, Simple Graphics, Complex Text and Complex Graphics, and are detailed in Section 3.6.2. Simple Text presents raw statistics and Simple Graphics presents a series of pie charts summarising general activity, file activity and forum activity. Complex Text presents values for Contribution, Communication and Activity, and Complex Graphics presents a series of line graphs, showing Contribution, Communication and Activity over time.

### ***Reportal & Prior Research***

The concept of participation awareness was founded in previous research by the author (Baatard, 2006), which made a preliminary examination of its impact within a groupware application. The groupware application was named Reportal, and was made to facilitate collaborative document authoring. Reportal allowed the structure of a length document to be defined and sections of it to be assigned to group members, who could then write and submit their sections before exporting the document as a whole.

Reportal featured a primitive version of the participation awareness mechanism found in GroupShare. While the concept was largely the same, the implementation of the mechanism was much less sophisticated, in terms of both metrics and presentation. The sole presentation style available most resembled the Complex Text style in GroupShare's participation awareness mechanism.

The participation awareness mechanism in Reportal was perceived as inaccurate and open to abuse by participants of the prior research, however the data also indicated that the feature had a positive impact on awareness and activity in the system. Hence, while the potential benefits of participation awareness were quite apparent, the research found that further refinement would be required in order to realise this.

### ***Spam, Noise & Gaming (Participation Awareness / Metrics)***

Spam, noise and gaming are methods of attempting to manipulate or mislead the participation awareness mechanism, usually in order to appear to be participating more. Spam and noise refer to performing numerous inane or unnecessary actions in the groupware environment, in order for these to be recognised and included by the participation awareness mechanism. Gaming is a more sophisticated technique, in

which the user gathers information regarding the underlying mechanics of the participation awareness mechanism and uses this to attempt a more effective manipulation, exploiting imbalances, bugs or oversights.

Depending on the actions performed, attempts to manipulate the participation awareness mechanism are often easily noticeable – either via the mechanism itself, other awareness mechanisms such as a recent activity list, or simply within the groupware application itself. The limits, and to a lesser extent the values, applied to participation awareness metrics aim to minimise the impact of spam, noise and gaming by discounting actions which exceed defined thresholds.

### ***Synchronous (Group Work)***

Synchronous group work is group work that is conducted via real-time interaction with other collaborators. Examples of synchronous group work include the real-time collaborative writing of a document or drawing of a diagram – such activities usually require specialised groupware. Often, synchronous group work is focused upon discussion, such as a meeting, lecture or brainstorm. Synchronous communication tools are typified by instant messaging, chat rooms, and audio/video conferencing.

### ***Teaching Staff / Staff Member (Academic Terminology)***

In the university in which the research was conducted, teaching staff refers to academic staff members who teach units. This entails delivering lectures and running workshops or tutorials, as well as writing and marking assessments. The term staff member is used synonymously, where appropriate.

### ***Unit (Academic Terminology)***

In the university in which the research was conducted, a unit refers to a semester-long period of topical study. Full-time students normally study four units per semester, while part-time students study two. Each of the thirteen teaching weeks typically consists of a lecture, followed by a practical workshop or tutorial. In units featuring group work, time is often dedicated to group-based work or meetings. Unit-based group work tends to involve either the collaborative authoring of a lengthy document, or the completion of a group project and associated documentation.

## **Appendix B – E-mail Sent to Teaching Staff**

The following request for support was e-mailed to staff members who taught units involving a significant amount of group-based work. Responses to the requests were further discussed in person and via further e-mails.

### **Subject: Request for PhD Research Support and Participation**

Greetings,

As a staff member lecturing units which involve group-based work, this e-mail requests your support for the PhD research of Greg Baatard. The research, which has ethics approval, is titled:

#### **A model for the measurement and presentation of participation awareness in online groupware systems.**

The research aims to build a generic model of participation awareness, a feature designed to generate and display a measure of group member participation in groupware applications. To do this, I wish to offer students in units which require group work the opportunity to use a groupware application with such a feature to complete their group-based unit work. The application is designed to assist small groups complete collaborative work online, and should prove quite useful to students.

Groups of students wishing to participate will be asked to use the groupware application to assist them in their group-based unit work throughout the semester. Usage data of the application will be collected over this period. I am also asking students who wish to participate to complete two questionnaires (one before using the application and one after the usage period has been completed), as well as allowing them to choose if they also wish to attend an interview after the usage period.

This research requires support from lecturers such as yourself in order to obtain participants. I am asking for support in one of two methods - opt out or opt in.

Opt out support will involve integrating the groupware application as the default group work application for the unit. The application is generic in nature, and able to support a wide variety of group-based work. Students will be asked to decide if they wish to opt out of the research and/or the usage of the application.

Opt in support will involve the groupware application and participation in the research being offered to students, and allowing them to decide if they wish to participate.

In either case, I will provide a demonstration of the application and explain the research. Students will be informed that participation is voluntary, can be discontinued at any time, and will have no impact on their grade.

Staff members offering support are also asked to be secondary participants to the research. This involves completing a short questionnaire and attending an interview at the end of the usage period, both regarding the measurement of participation.

Documents outlining GroupShare’s core features and possible usage scenarios have been attached.

### Contact Details

For further information, or any questions regarding the research, contact Greg Baatard at [REDACTED] or on [REDACTED].

You may also contact the supervisor of the research, [REDACTED], at [REDACTED] or on [REDACTED].

Both the researcher and the supervisor are from the [REDACTED], in the [REDACTED].

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer

[REDACTED]

Phone: [REDACTED]

E-mail: [REDACTED]

### Confidentiality of Collected Data

All data collected during the research will be stored on a secured computer in a locked room in [REDACTED], and will only be viewed by the researcher and research supervisor.

All collected data will be de-identified to ensure that participants remain completely anonymous. All names will be replaced by generic tags such as “Student 1”.

Data collected by the groupware application, questionnaires and interviews will be analysed to meet the aims of the research – the development of a generic model of participation awareness.

### Usage of Research Results

Results of the research will be published in a thesis, and possibly in an academic conference or journal. Participants may indicate if they wish to receive a summary of the results by checking the appropriate box in the Student Participation Form.

Thank you very much for your assistance.

Yours sincerely,  
Greg Baatard

# Appendix C – GroupShare Features Document

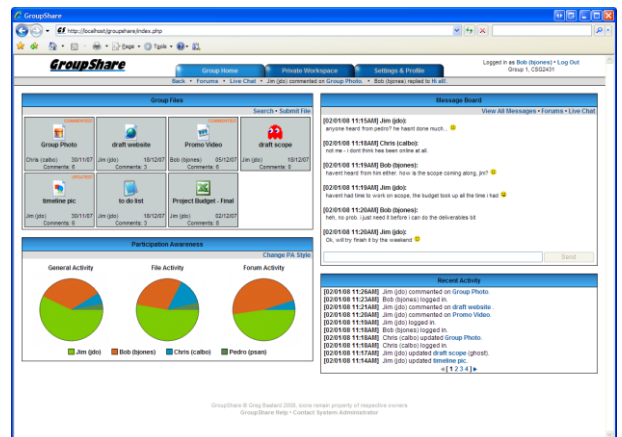
This document was attached to e-mails requesting staff member support for the research and e-mails to online students, in order to introduce the core features of GroupShare.

## Welcome to **GroupShare**

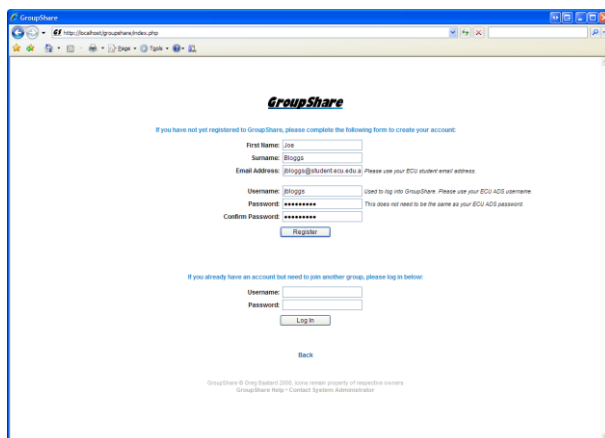
GroupShare is a fully online groupware system designed to allow small groups of people to collaborate in an online environment. Members of a group can use GroupShare to communicate and share files with each other. If required, please zoom in to view the screenshots in this document in greater detail.

Being fully online means that users can access GroupShare via a standard Web browser without needing to download or install an application.

The main page of GroupShare provides access to many of its primary features, displaying shared files, the message board and awareness mechanisms.



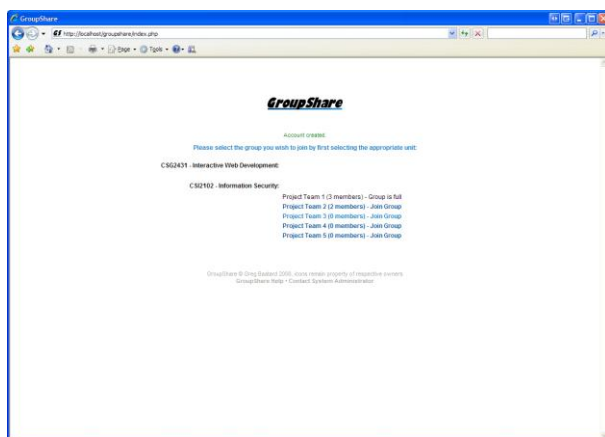
Main page of GroupShare



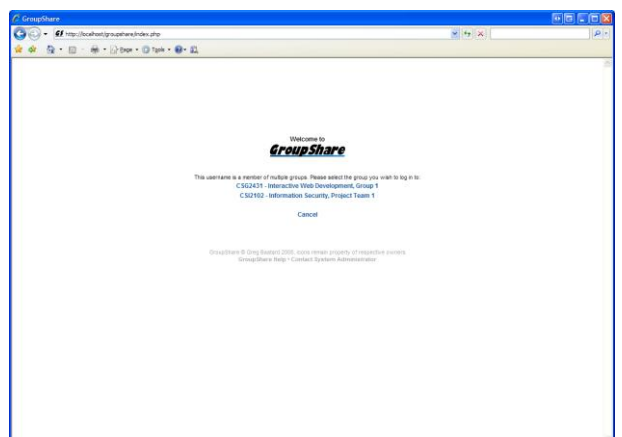
Registration is quick and simple

Users register an account in GroupShare and enrol themselves into the appropriate groups within the units which have been added to GroupShare by teaching staff and administrators.

Users can enrol in multiple groups in different units, using a single account.



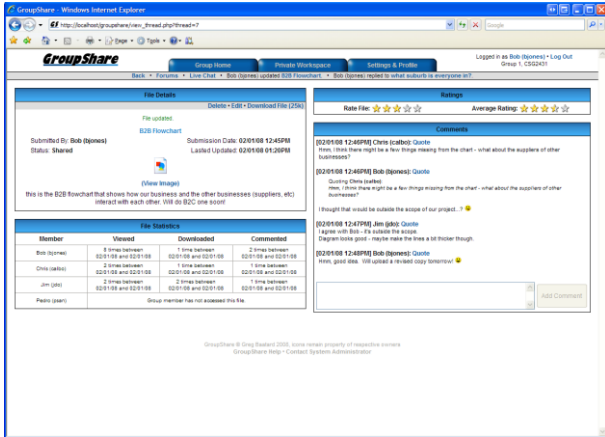
A registered user joins a group



Users can join multiple groups

## Sharing Files in GroupShare

Sharing files in a centralised online repository eliminates the issues caused by having multiple copies and versions of files on computers, thumb drives and e-mail inboxes.



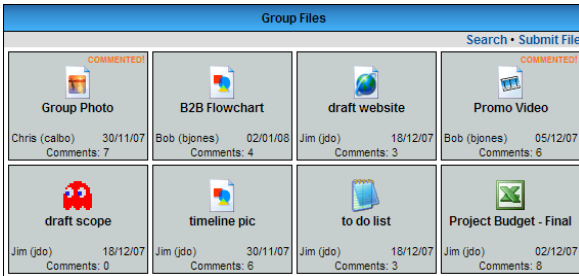
Viewing a shared file in GroupShare

Files of any format up to 15mb can be uploaded to share with the group or into a user's private area.

Files are securely stored and access permissions thoroughly checked before allowing a file to be downloaded.

Browser-supported image files and text files can be viewed within GroupShare. Text files containing code shown with syntax highlighting.

Files can be displayed as tiles or as a list.



Files displayed as tiles (from main page)

Group Files			
			Search • Submit File
	Group Photo Chris (calbo)	30/11/07	COMMENTS 7
	B2B Flowchart Bob (bjones)	02/01/08	Comments: 4
	draft website Jim (jdo)	18/12/07	Comments: 3
	Promo Video Bob (bjones)	05/12/07	COMMENTS 6
	draft scope Jim (jdo)	18/12/07	Comments: 0
	timeline pic Jim (jdo)	30/11/07	Comments: 6
	to do list Jim (jdo)	18/12/07	Comments: 3
	Project Budget - Final Jim (jdo)	02/12/07	Comments: 8

Files displayed in a list (from main page)

File Statistics			
Member	Viewed	Downloaded	Commented
Bob (bjones)	15 times between 30/11/07 and 02/01/08	1 time between 02/01/08 and 02/01/08	2 times between 30/11/07 and 05/12/07
Chris (calbo)	4 times between 30/11/07 and 10/12/07	1 time between 30/11/07 and 30/11/07	1 time between 30/11/07 and 30/11/07
Jim (jdo)	10 times between 30/11/07 and 02/01/08	No downloads.	2 times between 30/11/07 and 06/12/07
Pedro (psan)	Group member has not accessed this file.		

File statistics (from file view page)

Ratings	
Rate File: ★★★★★	Average Rating: ★★★★★☆

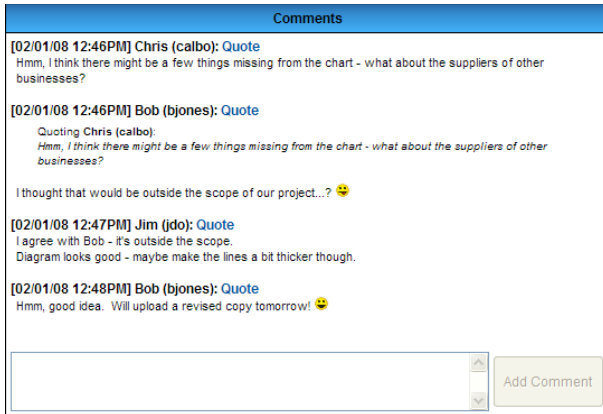
File rating (from file view page)

## Communicating in GroupShare

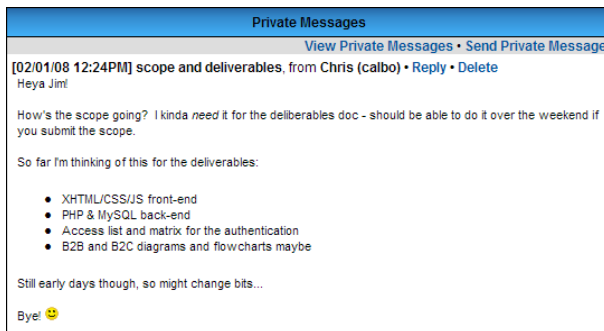
GroupShare offers several forms of communication:

- A simple message board on the main page of the system
- Commenting ability on all shared files
- Private messaging between users
- Discussion forums
- Live (real-time) chat

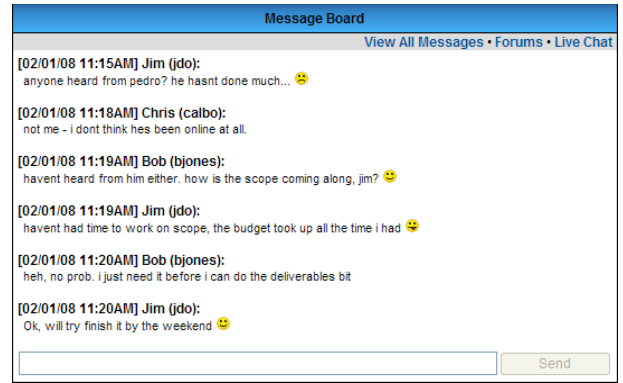
None of which require plug-ins or supporting software to be installed! Features such as emoticons and forum-style formatting are supported.



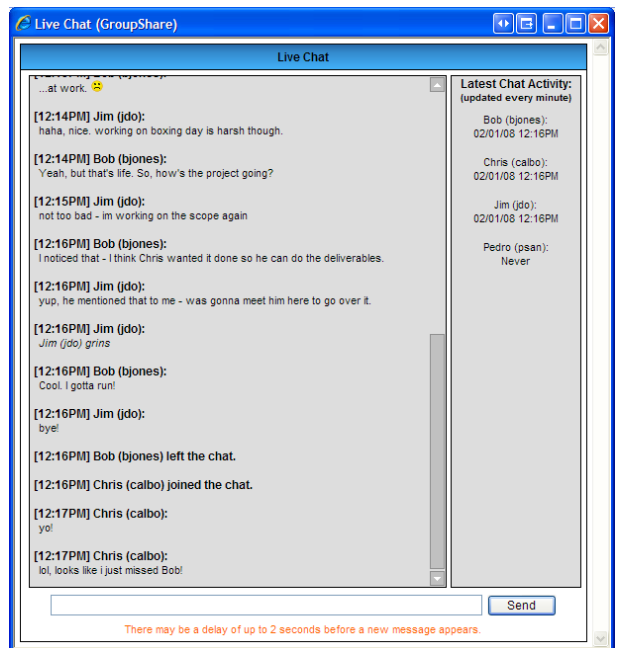
Commenting on shared files (from file view page)



Private messages (from private workspace page)

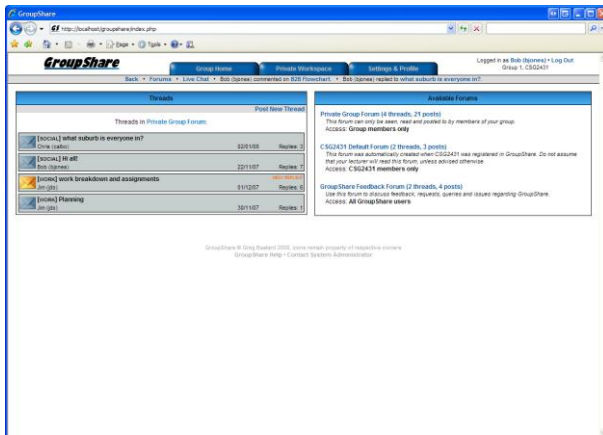


The message board (from main page)

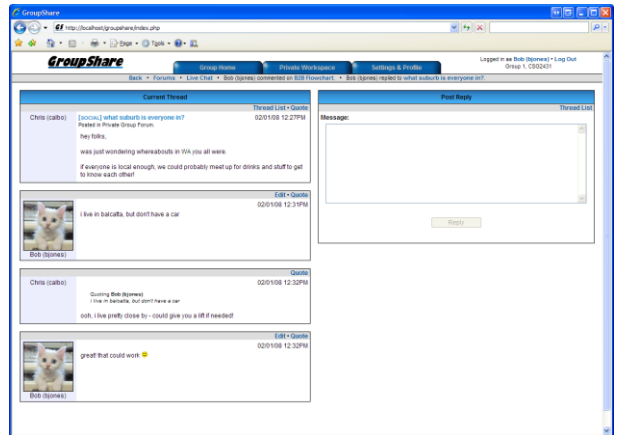


Live chat – no plug-ins required

Each group has a private forum, accessible only to members of that group. Unit and public (all GroupShare users) access forums can also be created by staff and administrators.



GroupShare forums



Viewing a thread



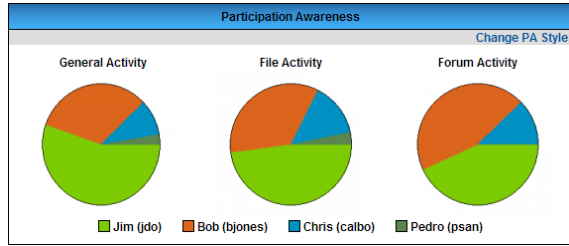
## Participation Awareness

Participation Awareness (PA) is a feature unique to GroupShare, and the focus of the PhD research of Greg Baatard, the developer of GroupShare. PA uses records of group member actions (logging in, submitting files, posting in forums, etc) in GroupShare and processes them to provide a cumulative, at-a-glance display of participation.

Group members can view PA in four styles, two of which are textual and two of which are graphical.

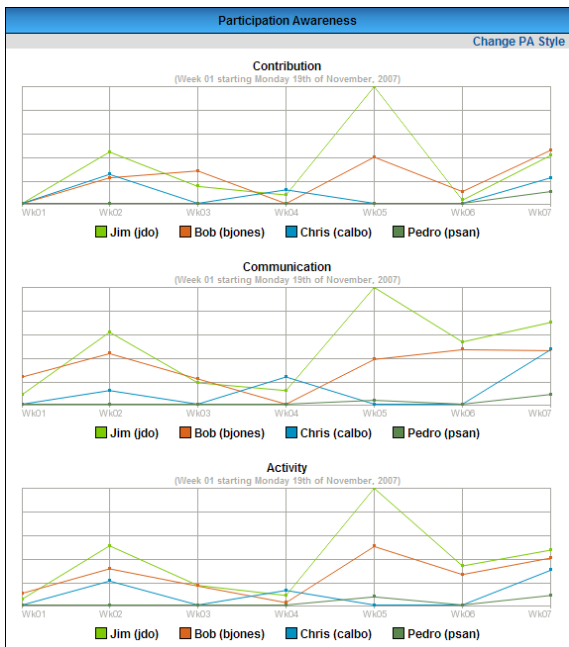
Participation Awareness	
<a href="#">Change PA Style</a>	
<b>Bob (bjones)</b> Total Logins: 24 (~0.6 per day since joining group) Shared File Contributions: 2 file submissions, 13 comments Shared File Views: 100% of shared files viewed (average delay of 21.4 hours) Work-Related PGF Posts: 3	
<b>Chris (calbo)</b> Total Logins: 9 (~0.3 per day since joining group) Shared File Contributions: 1 file submissions, 5 comments Shared File Views: 57% of shared files viewed (average delay of 1.2 days) Work-Related PGF Posts: 2	
<b>Jim (jdo)</b> Total Logins: 32 (~0.8 per day since joining group) Shared File Contributions: 8 file submissions, 12 comments Shared File Views: 100% of shared files viewed (average delay of 6.1 hours) Work-Related PGF Posts: 2	
<b>Pedro (psan)</b> Total Logins: 3 (~0.2 per day since joining group) Shared File Contributions: 0 file submissions, 2 comments Shared File Views: 38% of shared files viewed (average delay of 25.1 days) Work-Related PGF Posts: 0	

PA in "simple text" style



Participation Awareness				
<a href="#">Change PA Style</a>				
Member	Contribution	Communication	Activity	Overall
Bob (bjones)	Total: 135 Today: 35 (▲ 17%)	Total: 175 Today: 37 (▲ 28%)	Total: 357 Today: 55 (▼ 8%)	Total: 667 Today: 127 (▲ 7%)
Chris (calbo)	Total: 39 Today: 0 (▼ *)	Total: 83 Today: 11 (▼ 82%)	Total: 122 Today: 14 (▼ 72%)	Total: 224 Today: 25 (▼ 73%)
Jim (jdo)	Total: 178 Today: 31 (▲ 7%)	Total: 240 Today: 39 (▲ 5%)	Total: 492 Today: 51 (▼ 20%)	Total: 908 Today: 121 (▼ 7%)
Pedro (psan)	Total: 16 Today: 8 (● 0%)	Total: 23 Today: 14 (▲ 133%)	Total: 48 Today: 18 (▲ 13%)	Total: 87 Today: 40 (▲ 33%)

PA in "complex text" style



Group-based assignments are often disliked by university students for a number of reasons, typically concerning participation. By providing a cumulative and at-a-glance display of participation, GroupShare's PA feature aims to make collaborative work (particularly in an online environment) more effective and enjoyable.

Indirect participation (e.g. viewing files or reading a thread) and transparent actions (e.g. logging in or downloading a file) are taken into account, and actions are also weighted and limited to deter noise (appearing very active, but contributing little) and gaming (performing actions in GroupShare with the intention of tricking the PA feature).

## Other Features!

GroupShare contains many other features:

- Users can share some information about themselves to their group members via profiles
- Designed to work with all connection speeds and compatible with all major browsers
- Trophy system rewards participation
- Multiple awareness mechanisms to announce events within group
- Private workspace allows users to keep track of their files, notes, private messages and trophies
- Users can tweak settings to customise GroupShare to their tastes

GroupShare aims to make working in a group online a more effective, efficient and enjoyable experience!

**GroupShare**  
By Greg Baatard

# Appendix D – GroupShare Usage Scenarios

This document was attached to e-mails requesting staff member support for the research, in order to present possible usage scenarios of GroupShare to support group work.

## GroupShare Sample Usage Scenarios

This document illustrates a few of the possible scenarios in which GroupShare can be used to support group work. If required, please zoom in to view the screenshots in this document in greater detail.

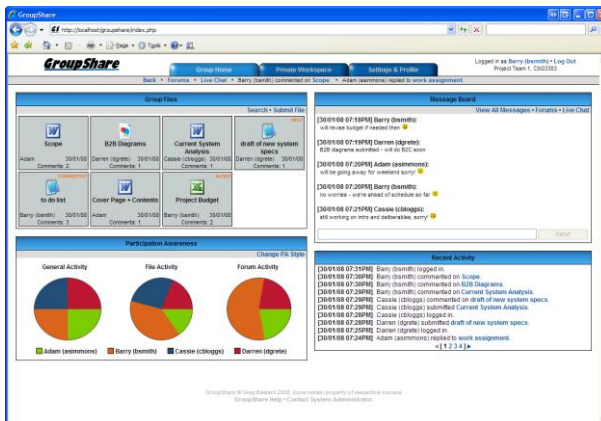
For more information about GroupShare itself, please see [REDACTED]

### Scenario 1: Lengthy Document Creation

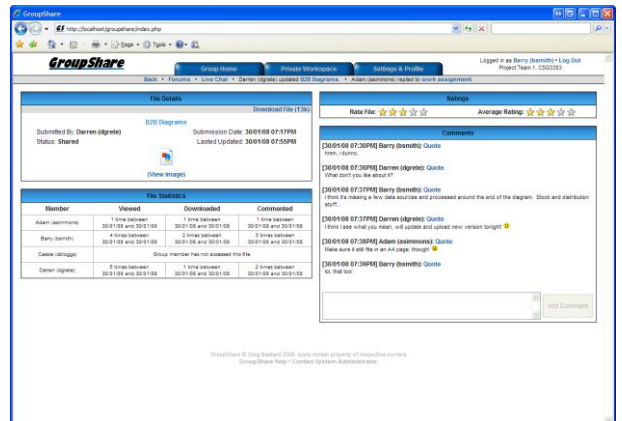
Groups of students are required to produce a lengthy document, such as a project plan or a report.

#### How GroupShare can help:

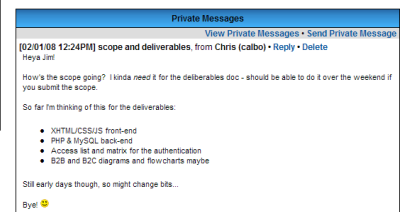
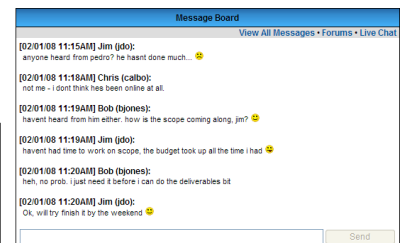
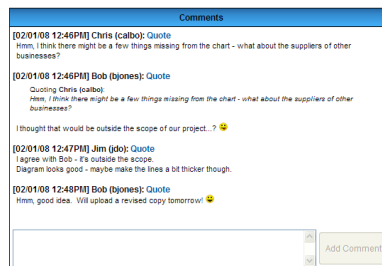
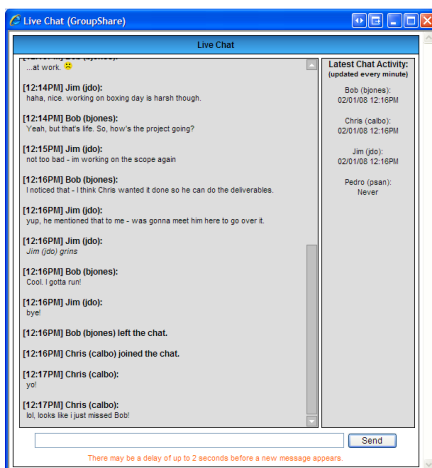
- Students can upload parts of the document as they write them. These can be shared with the group, or kept in their private workspace for personal access from any computer.
- Shared files can be viewed, commented upon and rated by group members.
- Uploaded files can be edited and updated by the author, allowing them to keep a single current version available to all group members.
- Comments, message board posts, discussion forums, private messages and live chat can all be used to communicate and collaborate between group members.



GroupShare main screen, showing shared files



GroupShare file view, showing group member feedback



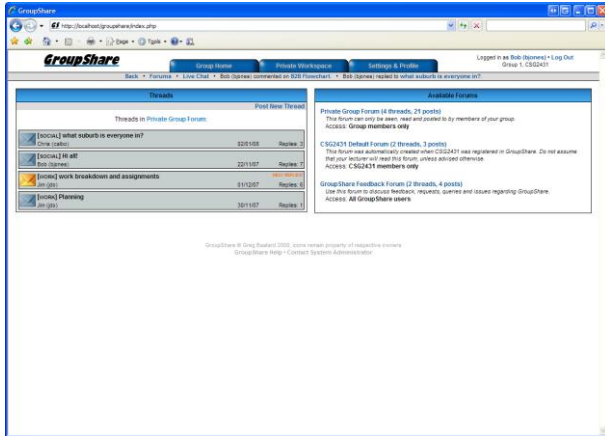
Various communication tools available in GroupShare

## Scenario 2: Group & Unit Based Discussion

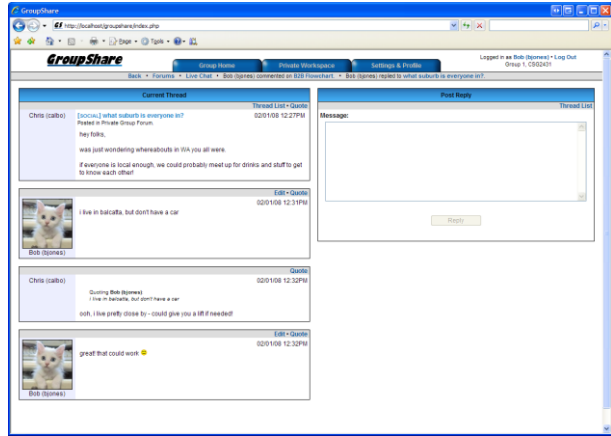
Students are required to discuss topics within groups and within the unit at large.

### How GroupShare can help:

- Each group has access to its own private discussion forum where threaded conversations can be held.
- Unit-based forums also available, which can be created, modified and participated in by unit staff members.
- Forums are quick and easy to use, supporting features such as post editing, quoting, thread rating, text formatting and avatar images.
- User profiles allow group members to get to know each other better.



GroupShare discussion forums page



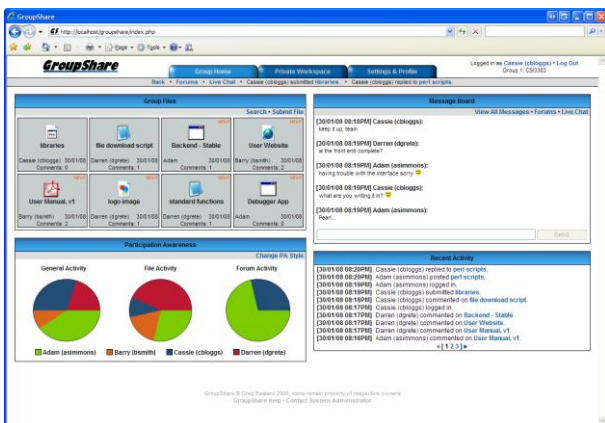
Viewing a thread in a GroupShare discussion forum

## Scenario 3: Software Development

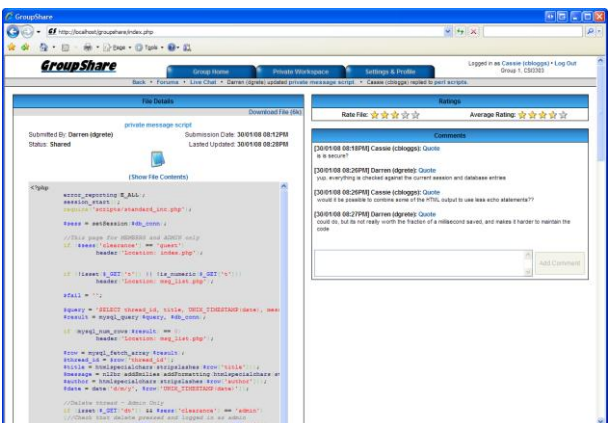
Groups of students are required to write code and develop an executable application.

### How GroupShare can help:

- No restriction on file type uploads allows students to share all necessary files – source code, compiled executables, documentation, supporting files...
- Content of source code files are viewable in GroupShare, appearing with syntax highlighting and formatting.
- Group members can take notes in their private workspace, to keep track of links, code snippets, etc. Notes retain formatting for easier code recognition.
- Comments, message board posts, forums, private messages and live chat can all be used to communicate and collaborate between group members.



GroupShare main page, showing various shared file types



GroupShare file view, showing syntax highlighting

These are just a few examples of the possible usage scenarios of GroupShare. The system was designed from the ground up to be as flexible and generically applicable as possible.

## Appendix E – Informed Consent Form

The following consent form was completed by students who wished to participate in the research, after an introduction and GroupShare demonstration. An electronic version of the form was e-mailed to online students.

### Informed Consent

This form regards the research project is being undertaken by Greg Baatard for a Doctor of Philosophy (Computer Science) at [REDACTED] titled:

#### **A model for the measurement and presentation of participation awareness in online groupware systems.**

The research has been approved by the [REDACTED] Human Research Ethics Committee.

#### Contact Details

For further information, or any questions regarding the research, contact Greg Baatard at [REDACTED] or on [REDACTED].

You may also contact the supervisor of the research, [REDACTED], at [REDACTED] or on [REDACTED]. Both the researcher and the supervisor are from the [REDACTED], in the [REDACTED].

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer

[REDACTED]

Phone: [REDACTED]

E-mail: [REDACTED]

#### Intent to Participate

You have received an Information Letter describing the aims and procedures of the research. Participants are asked to use the groupware application (GroupShare) to assist them in their group-based unit work as appropriate throughout the semester. Usage data will be gathered over the usage period, and questionnaires will be administered before and after this period. Participants may also choose to take part in a post-usage interview.

All information collected will remain confidential and anonymous, and only be used to meet the aims of the research. If you have any questions regarding the research which have not been answered, please ask the researcher now or contact one of the people listed in this form and the Information Letter.

Students are reminded that participation is entirely voluntary, can be withdrawn at any time, and will have no impact on their grade. If you have read and understood all the information provided, and wish to participate in the research, please complete the details on the reverse of this page and sign where indicated, then return the completed form to Greg Baatard.

**Student Participation Form**  
(please write clearly)

FIRST NAME: \_\_\_\_\_


SURNAME: \_\_\_\_\_

AGE:            Under 21 [ ]    21-30 [ ]    31-40 [ ]    41-50 [ ]    Over 50 [ ]

GENDER:    Male [ ]    Female [ ]

NATIONALITY (optional):

\_\_\_\_\_

 STUDENT E-MAIL ADDRESS:

\_\_\_\_\_

Please check this box if you would be willing to be contacted for an interview regarding your experiences with the system, towards the end of semester: [ ]  
*(you will be asked to confirm this choice in the post-usage questionnaire)*

Please check this box if you wish to be advised of the outcomes of this research: [ ]

**I have read the attached information and wish to participate in the research.**

**SIGNED:** \_\_\_\_\_

**DATE:** \_\_\_\_/\_\_\_\_/\_\_\_\_

## Appendix F – E-mail Sent to Online Students

This e-mail was sent to online students in participating units. Attached to the e-mail were the GroupShare features document (Appendix C), the informed consent form (Appendix E) and the information letter (Appendix G). As the e-mail was sent by the staff members lecturing the units in question, minor differences existed between e-mails, as indicated.

[INTRODUCTION/SALUTATION TO STUDENT]

[UNIT CODE AND NAME] is a unit which contains a large amount of group work, which can be challenging for online or external students. Your group is...

[GROUP DETAILS]

This semester, an online groupware tool called GroupShare is available to support us in our group work. GroupShare was developed by PhD student Greg Baatard, who is performing research regarding group work and the "participation awareness" feature in GroupShare. Details of the research can be found in the Information Letter to Participants (attached). An Informed Consent form is also attached - if convenient, this should be printed, completed and given to [REDACTED]. Otherwise, an e-mail to [REDACTED] or Greg with the relevant information will suffice - an area for this has been provided at the end of this e-mail.

GroupShare is located at [REDACTED]  
A document outlining its core features has been attached.

To log in, use your ADS username (this is the same as the first part of your student e-mail address) as the user name and your student number as the password. Once logged in, you can change your password via the Profile & Settings page.

In exchange for usage of the system, students are asked to participate in the research by completing a pair of questionnaires - one at the beginning of the semester, and one after the completion of the group work. Please complete the first questionnaire as soon as possible. It is located at [REDACTED]

Participation is voluntary. If you do not wish to use GroupShare or participate in the research, please let [REDACTED] know. You may opt out of the research at any time, and your choice to participate will have no impact on your grade. All information gathered in the research will be anonymised and remain confidential.

Please contact Greg Baatard at [REDACTED] (e-mail or MSN) with any queries regarding GroupShare, the questionnaires, or his PhD research.

[CLOSING REMARKS/SIGNATURE]

[TEXT REPLICATING CONTENT OF CONSENT FORM]

## **Appendix G – Information Letter**

This information letter was provided to students in participating units during the author's introduction of the research and demonstration of GroupShare. Online students were provided with an electronic copy.

### **Information Letter to Participants**

This research project is being undertaken by Greg Baatard for a Doctor of Philosophy (Computer Science) at [REDACTED].

The research is titled:

#### **A model for the measurement and presentation of participation awareness in online groupware systems.**

The research has been approved by the [REDACTED] Human Research Ethics Committee.

#### **Description of Research**

This research introduces an online groupware application (GroupShare) designed to assist small groups complete collaborative work. Such a task is required in this unit, making you eligible to participate in the research if you choose.

The research aims to build a generic model of “participation awareness”, a feature which is present in the groupware application. To do this, the research intends to identify the metrics which must be taken into account in order to measure participation, and the way in which this information must be processed and presented to users in order to be deemed effective and accurate.

Awareness mechanisms such as participation awareness facilitate effective collaboration, especially within online environments. By building a generic model of participation awareness, such a feature can be implemented in other groupware applications and further research can be conducted in the area.

I am asking students to use the GroupShare to assist them in their group-based unit work throughout the semester. Usage data of the system will be collected over this period. I am also asking students who wish to participate to complete two questionnaires - one at the start of semester before using the application, and one at the end of the usage period.

To further assist the research, I would like to conduct short interviews with some participants at the completion of the usage period. You will be asked if you wish to attend an interview in the post-usage questionnaire.

Students are informed that they may opt out of the research at any time, and that participation is entirely voluntary and will have no impact on their grade.

**Important Addresses & Information**

GroupShare: [REDACTED]

Pre-Usage Questionnaire: [REDACTED]

Email & MSN Contact: [REDACTED]

*To get started, go to GroupShare and register an account for yourself via the link on the login page. Join your group's group, and then please complete the Pre-Usage Questionnaire as soon as possible.*

**Contact Details**

For further information, or any questions regarding the research, contact Greg Baatard at [REDACTED] or on [REDACTED].

You may also contact the supervisor of the research, [REDACTED], at [REDACTED] or on [REDACTED].

Both the researcher and the supervisor are from the [REDACTED], in the [REDACTED].

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer

[REDACTED]

Phone: [REDACTED]

E-mail: [REDACTED]

**Confidentiality of Collected Data**

All data collected during the research will be stored on a secured computer in a locked room in [REDACTED], and will only be viewed by the researcher and research supervisor.

All collected data will be de-identified to ensure that participants remain completely anonymous. All names will be replaced by generic tags such as "Student 1".

Data collected by the groupware application, questionnaires and interviews will be analysed to meet the aims of the research – the development of a generic model of participation awareness.

**Usage of Research Results**

Results of the research will be published in a thesis, and possibly in an academic conference or journal. Participants may indicate if they wish to receive a summary of the results by checking the appropriate box in the Student Participation Form.

Thank you very much for your assistance.

Yours sincerely,  
Greg Baatard



## Appendix H – Pre-Usage Questionnaire

This appendix presents the pre-usage questionnaire, described in Section 3.4.2. The questionnaire is reproduced as it was presented to participants via the Web-based questionnaire interface. Responses to the questionnaire are examined in Section 4.2.

### **GroupShare** Pre-Usage Questionnaire

#### Welcome & Instructions

Thank you for volunteering to take part in my research - I hope you find GroupShare to be a useful tool and wish you all the best in your studies. Before you start using GroupShare, please complete this questionnaire. The questionnaire should only take 10-20 minutes of your time. Participation in my research is entirely voluntary and strictly confidential.

This questionnaire is divided into **6 parts**. As you complete each part and click the "Next >>" link, the part will be validated and any errors will be highlighted for you. Please complete all questions as they apply to you. Please do not refresh the page or use the back feature in your browser during the survey, as this may reset the form.

This research has been approved by the [REDACTED] Ethics Committee. If you have any questions regarding GroupShare, this research or this questionnaire, please feel free to contact me at [REDACTED], or [REDACTED] (supervisor of the research) at [REDACTED].

To begin, please enter your **student e-mail address and GroupShare username**. If you are currently logged in to GroupShare from this computer, these fields will be filled in for you - please double-check them. If you have not yet registered in GroupShare, please enter "none" as your username.

**Student E-mail Address:**       **GroupShare Username:**

Thank you once again for participating in my research.

Regards,  
Greg Baatard

#### Part 1: Internet Usage & Experience

**The following questions concern your Internet usage and experience.**

1. Approximately how often do you typically use the Internet, including e-mail, during a *week*?:  
 Less than twice a week     Several times a week     Once a day     More than once a day
2. Approximately how long do you typically spend using the Internet, including e-mail, during a *day*?:  
 Less than 2 hours     2 to 5 hours     6 to 10 hours     More than 10 hours

**3. From where do you regularly access the Internet?:**

Check all that apply.

- Home
- Work
- University
- Public Access (e.g. Internet Café or Library)
- Other, please specify:

**4. What activities to you typically use the Internet for?:**

Check all that apply.

- Socialising (including e-mail, social networking, chatting, forums and messaging)
- Study (including university and work, or independent educational usages)
- Entertainment (including gaming and all forms of media)
- Downloading (downloading things such as software, music, movies and games)
- Other, please specify:

**5. What speed Internet connection do you most often use?:**

- Low Speed (dialup)     High Speed (broadband, cable, etc)

**6. I consider myself to be an experienced Internet user:**

- Strongly Disagree     Disagree     Neutral     Agree     Strongly Agree

**7. I often use resources on the Internet to support my studies:**

- Strongly Disagree     Disagree     Neutral     Agree     Strongly Agree

## Part 2: University Enrolment Details

The following questions concern your current enrolment at [REDACTED].

**8. What course or degree are you currently enrolled in at [REDACTED]?:**

**9. What is your current level of study?:**

- Undergraduate     Postgraduate

**10. Are you currently a full-time or part-time student?:**

- Full-time     Part-time

**11. What is your current mode of study?:**

- On Campus     Online / External     Mixed

**12. Which mode of study do you typically prefer?:**

- On Campus     Online / External     Mixed

## Part 3: Group Work

The following questions concern your thoughts and experiences with working in groups of between 2 to 8 people to complete unit work (e.g. assignments) in your university studies.

**13. Approximately how many times have you been required to work in a group as part of your university studies?:**

- Never     1 to 3 times     4 to 6 times     7 to 9 times     More than 10 times

14. Approximately how much of this group work was conducted primarily online?:

- None  Some  Half  Most  All

15. When completing group work I find that a large amount of the communication and collaboration takes place online, regardless of my mode of study:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

16. When working in groups, I prefer to be the group leader:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

17. I feel that I learn more in assignments requiring group work compared to those requiring individual work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

18. Assignments requiring group work are less appealing than those requiring individual work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

19. I feel that assignments requiring group work are more challenging than those requiring individual work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

20. An up-to-date understanding of group members' work-related activities is important in group assignment work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

21. Equal participation by group members is important in group assignment work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

22. In my previous group assignment work, participation was equal amongst all group members:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

23. I feel that I work well in a group:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

24. I feel that I understand the potential benefits of including group assignment work in university studies:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

25. In my experience, I feel that these benefits are usually fully achieved:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

26. What are your primary means of contacting group members when completing group-based unit work?:

Check all that apply.

- E-mail  
 In Person  
 Instant Messaging (e.g. MSN, IRC, AIM, YIM...)  
 Blackboard  
 Telephone (including VoIP)  
 Online Forum / Web site (e.g. Google Groups or Facebook)  
 Other, please specify:

27. What do you like the *most* about group work?:

28. What do you like the *least* about group work?:

#### Part 4: Group Support Software (Groupware)

The following questions concern your thoughts and experiences regarding software and online systems used to support group work.

This type of software/online system is commonly known as "groupware".

29. Have you used an online learning environment such as BlackBoard or eCourse in your university studies?:

- Yes  No

30. Have you used groupware to support group work unrelated to your university studies?:

e.g. for work or personal projects.

- Yes  No

31. Which of the following groupware systems have you used to support any kind of group work?:

Check all that apply.

- Lotus Notes  
 Microsoft SharePoint or Exchange  
 Basic Support for Collaborative Work (BSCW)  
 Yahoo! Groups, Google Groups or similar  
 Other, please specify:

31a. If applicable, please summarise what the system(s) were used for:

32. I feel that using groupware to support group work is beneficial, even when some face-to-face contact is possible:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

33. I feel that using a dedicated groupware system (such as those listed in question 31) to support group work is more beneficial than using a general communication tool (e.g. e-mail, forum or instant messaging):

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

#### Part 5: Participation in Group Work

The following questions concern your thoughts and opinions regarding the participation of individual group members in group work. For the purposes of this research and questionnaire, "*participation*" in group work is defined as any work-related activity, including both "*direct*" actions such as contributing work, and "*indirect*" actions such as viewing the work of others.

34. I believe that *participation* in group work involves more than the direct contribution of work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

35. Please indicate how important you feel the following things are when participating in group work:

	Very Unimportant	Unimportant	Neutral	Important	Very Important
35a. Contributing work:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35b. Communicating with other group members:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35c. Remaining up-to-date with the overall status of the project and the work of other group members:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35d. Providing feedback on the work of other group members:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

36. Direct participation refers to ways in which group members can directly contribute to the completion of group work.

Please rank the following aspects of direct participation in order of importance, with 1 being the most important:

It may help to ask yourself questions like "Would I prefer a high quality submission at the last minute, or a low quality submission early?".

- Contributions are of high quality.
- Contributions are of appropriate length.
- Contributions are timely (e.g. not submitted at the last minute).
- All assigned work is completed.

36a. If you wish to elaborate on your rankings, please do so here:

37. Indirect participation refers to indirect ways in which group members can assist in the completion of group work.

Please rank the following aspects of indirect participation in order of importance, with 1 being the most important:

- Group member demonstrates up-to-date knowledge regarding the overall status of the project.
- Group member shares thoughts, opinions and feedback on work contributed by other group members.
- Group member communicates with the rest of the group in a social manner.
- Group member reads/views all work contributed by other group members.

37a. If you wish to elaborate on your rankings, please do so here:

38. What do you feel are the most important aspects of participation (direct or indirect) in group work?:

i.e. What qualities do you value the most in a group member?

39. What approaches (if any) have you used to judge the direct and indirect participation of your group members in your previous group work experience?:

## Part 6: Measuring Participation in Online Groupware

The following questions concern your thoughts and opinions regarding the measurement of participation in group work conducted in online groupware environments.

40. I sometimes find it difficult to know how much a group member is participating in online group work:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

41. I feel it would be useful to have a better understanding of the participation of group members in online group work:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

42. I feel it would be useful to know more about the passive/unseen actions (e.g. logging in, viewing work, reading messages) of group members in online group work:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

43. In measuring an individual's participation in group work, I feel the *quality* of contributions is more important than the *number* of contributions:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

44. I feel that I would rate group member contributions with complete honesty, when doing so *anonymously* in a groupware environment:

Assuming a rating scale of 1 to 5 stars.

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

45. I feel that I would rate group member contributions more honestly when face-to-face than in a groupware environment, regardless of anonymity:

Assuming a rating scale of 1 to 5 stars.

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

46. What impact do you feel a display of group member participation will have on group work in an online environment?:

### Finish

If you wish, you can review previous sections by clicking the "<< Previous" and "Next >>" links - remember not to use your browser's back feature.

If you have **any further comments** you feel are relevant, please write them below.

Please **press the submit button** to submit your completed questionnaire.

Submit Survey

Thank you very much for completing this questionnaire. Best of luck for the semester, and I hope you find GroupShare to be a useful tool in your studies!

# Appendix I – Post-Usage Questionnaire

This appendix presents the post-usage questionnaire, described in Section 3.4.3. The questionnaire is reproduced as it was presented to participants via the Web-based questionnaire interface. Responses to the questionnaire are examined in Section 4.4.

## **GroupShare** Post-Usage Questionnaire

### Welcome & Instructions

Thank you for participating in my research and using GroupShare to help with your studies this semester – I hope you found the system to be useful. Please complete this questionnaire, which asks you to reflect upon GroupShare and the Participation Awareness (PA) mechanism. The questionnaire should only take 10-20 minutes of your time.

This questionnaire is divided into **5 parts**. As you complete each part and click the "Next >>" link, the part will be validated and any errors will be highlighted for you. Please complete all questions as they apply to you. Please do not refresh the page or use the back feature in your browser during the survey, as this may reset the form.

This research has been approved by the [REDACTED] Ethics Committee. If you have any questions regarding GroupShare, this research or this questionnaire, please feel free to contact me at [REDACTED], or [REDACTED] (supervisor of the research) at [REDACTED].

To begin, please enter your **student e-mail address and GroupShare username**. If you are currently logged in to GroupShare from this computer, these fields will be filled in for you - please double-check them.

**Student E-mail Address:**  **GroupShare Username:**

Thank you once again for participating in my research.

Regards,  
Greg Baatard

### Part 1: General Group Work & GroupShare Usage

**The following questions concern how you and your group worked this semester, and your GroupShare usage.**

1. Approximately how often did you typically access GroupShare over the usage period?:

- Less than twice a week    Several times a week    Once a day    More than once a day

2. On average, how long did you use GroupShare for each time you logged in?:

- Less than 10 minutes    10 to 30 minutes    30 minutes to an hour    More than an hour

3. If you/your group used GroupShare significantly more or less during certain parts of the usage period, please specify:

4. Approximately how often did you have face-to-face contact with your group members?:

- Never  Monthly  Every two weeks  Weekly  More than weekly

5. Approximately how often did you have contact with group members by other means (not face-to-face or using GroupShare)?:  
e.g. by phone or e-mail.

- Never  Monthly  Every two weeks  Weekly  More than weekly

6. If you have any further comments regarding your group work and usage of GroupShare that you feel are relevant, please write them below:

## Part 2: General GroupShare Feedback

The following questions concern your thoughts regarding GroupShare.

7. GroupShare made working in a group easier to manage:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

8. GroupShare made working in a group more enjoyable:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

9. The design and interface of GroupShare allowed me to use the system effectively:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

10. GroupShare was well suited to support the tasks required in my group:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

11. I feel that GroupShare is more useful for groups working primarily online, with little or no face-to-face contact:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

12. GroupShare made communicating with my group members easy:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

13. I feel that GroupShare had an overall positive effect on my group's performance and outcomes:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

14. I would like to use GroupShare again in future group work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree



15. Which aspects of GroupShare did you like the *most*?:

16. Which aspects of GroupShare did you like the *least*?:

17. How do you feel GroupShare could be improved?:

### Part 3: Participation Awareness – General Feedback

The following questions concern the participation awareness (PA) feature in the main page of GroupShare. Please answer these questions from a general perspective – questions regarding the different PA styles will be asked in the next part of the questionnaire.

18. I placed a significant amount of importance on the PA feature:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

19. I feel that the PA feature accurately reflected my participation in the group:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

20. I feel that the PA feature accurately reflected the participation of other group members:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

21. I found that the PA feature encouraged me to be more active in the group:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

22. I found that the PA feature encouraged me to work harder:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

23. I found that the PA feature helped me to understand my group members:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

24. I found that the PA feature made group work more stressful:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

25. I found that the PA feature made group work more competitive:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

26. The PA feature made it easier to keep track of how much group members were participating:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

27. Overall, I found the PA feature made group work more enjoyable:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

28. Overall, I found the PA feature to have a positive effect on the group:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

29. Please comment on what you feel to be the *positive* impacts of the PA feature, if any:

30. Please comment on what you feel to be the *negative* impacts of the PA feature, if any:

#### Part 4: Participation Awareness – Presentation Styles

The following questions concern the different participation awareness (PA) styles you were able to choose from. If you have not already done so during the semester, please familiarise yourself with the different styles in GroupShare by clicking the "Change PA Style" link in the Participation Awareness area.

Examples and definitions of each style are provided on [this page](#) (opens in a new window).

31. Approximately how often did you switch between different PA styles during the usage period?:

- Never    Monthly    Every two weeks    Weekly    More than weekly

32. Which PA style do you feel gave the best "at-a-glance" information, regardless of accuracy?:

- Simple Text    Simple Graphics    Complex Text    Complex Graphics

33. Which PA style do you feel provided the most useful information?:

- Simple Text    Simple Graphics    Complex Text    Complex Graphics

34. Which PA style did you find the most appealing, visually?:

- Simple Text    Simple Graphics    Complex Text    Complex Graphics

35. Which PA style did you most prefer?

Please rank the PA styles in order of overall preference, with 1 being the most preferred:

- Simple Text  
 Simple Graphics  
 Complex Text  
 Complex Graphics

35a. If you wish to elaborate on your rankings, please do so here:

36. Which PA style did you feel presented you and your group members' participation the most accurately?

Please rank the PA styles in order of accuracy, with 1 being the most accurate:

- Simple Text  
 Simple Graphics  
 Complex Text  
 Complex Graphics

36a. If you wish to elaborate on your rankings, please do so here:

37. If you have any further comments regarding the PA styles or the *presentation* of PA that you feel are relevant, please write them below:

### Part 5: Participation Awareness – Actions & Metrics

The following questions concern your opinions and understanding of the actions (such as logging in, submitting work or providing feedback) within GroupShare which influenced the participation awareness (PA) feature.

38. I read information (e.g. the PA help topic or glossary) in order to better understand the PA feature:

- Yes  No

39. I had a reasonable understanding how the PA feature worked, and what actions influenced it:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

40. I feel that the actions which influenced the PA feature were appropriate:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

41. I feel that my actions did *not* influence the PA feature in the way I expected:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

42. I feel that certain actions influenced the PA feature more or less than I expected:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

42a. If you agreed or strongly agreed with the previous statement, please specify:

43. I made an effort to rate the shared files and/or forum threads of other group members:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

44. I feel that ratings should have a larger impact on the PA feature:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

45. Knowing that the PA feature relied mostly on the number of actions rather than their "quality" influenced my perception of the feature's accuracy:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

46. I found that the actions which influenced the PA feature suitably reflected the overall quality of my group members' participation:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

47. If you have any further comments regarding the *actions and metrics* of the PA feature that you feel are relevant, please write them below:

### Finish

If you wish, you can review previous sections by clicking the "<< Previous" and "Next >>" links - remember not to use your browser's back feature.

If you have **any further comments** you feel are relevant, please write them below.

Please **press the submit button** to submit your completed questionnaire.

Submit Survey

Thank you very much for completing this questionnaire and for participating in my research!

## Appendix J – Staff Questionnaire

This appendix presents the staff questionnaire, described in Section 3.4.4. The questionnaire is reproduced as it was presented to staff members via the Web-based questionnaire interface. Responses to the questionnaire are examined in Section 4.6.

### **GroupShare** Staff Questionnaire

#### Welcome & Instructions

Thank you for taking part in and supporting my research - I hope you and your students found GroupShare to be a useful tool. Please complete this questionnaire, which asks you to reflect upon group work and participation. The questionnaire should only take 5-15 minutes of your time.

This questionnaire is divided into **3 parts**. As you complete each part and click the "Next >>" link, the part will be validated and any errors will be highlighted for you. Please complete all questions as they apply to you. Please do not refresh the page or use the back feature in your browser during the survey, as this may reset the form.

This research has been approved by the [REDACTED] Ethics Committee. If you have any questions regarding GroupShare, this research or this questionnaire, please feel free to contact me at [REDACTED], or [REDACTED] (supervisor of the research) at [REDACTED].

To begin, please enter your **name**.

Name:

Thank you once again for participating in and supporting my research.

Regards,  
Greg Baatard

#### Part 1: Participation in Prolonged Group Work

**The following questions concern your thoughts and experiences regarding student participation in prolonged group work (across several weeks or months) within your units.**

1. I find that most students prefer prolonged group work above individual work:

Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

2. In my experience, students often use online methods to communicate and collaborate with their group, even when studying on campus:

Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

3. I find it difficult to have a good understanding of individual student participation in prolonged group work:

Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

4. I find it difficult to determine if students have participated equally when assessing the outcomes of prolonged group work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

5. The first time I usually hear about a problem in a group is when one of the members comes to me regarding it:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

6. I have measures in place to help ensure student participation *during* prolonged group work:

- Yes  No

6a. If you answered yes to the previous statement, please specify:

7. I have measures in place to help check student participation *at the completion of* prolonged group work:

- Yes  No

7a. If you answered yes to the previous statement, please specify:

8. What factors do you tend to use to form an initial perception of a student's participation in group work?:  
e.g. class attendance, observation of group dynamics, forum postings etc.

## Part 2: Participation Awareness

The following questions concern your thoughts and experiences regarding the inclusion of participation awareness feature in a groupware environment such as GroupShare.

Examples of GroupShare's participation awareness feature can be found on [this page](#) (opens in a new window).

9. I feel that a display of participation awareness in a groupware system would benefit me in assessing student participation in prolonged group work:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

10. I feel that a display of participation awareness in a groupware system may have a negative impact on some groups/individuals:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

10a. If you agreed or strongly agreed with the previous statement, please specify:

11. I feel that a display of participation awareness in a groupware system may encourage students to be more active in their group:

- Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

12. Overall, I feel that a display of participation awareness in a groupware system could benefit students in prolonged group work:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

13. Did you use GroupShare's staff interface to view student groups during the semester?:

- Yes    No

If you answered yes to the previous question, please complete the following two questions.

13a. Did you find the participation awareness feature easy to understand?:

- Yes    Did not notice    No

13b. Did the participation awareness feature reflect your own perceptions regarding the participation of students?:

- Yes    Did not notice / Did not have pre-existing perceptions    No

14. I would be willing to use GroupShare again in the future to support prolonged group work in my classes (unrelated to research):

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

15. If students gave you feedback regarding the participation awareness feature or GroupShare in general which you feel could be relevant, please summarise it below:

### Part 3: Aspects of Participation

The following questions concern your thoughts and opinions regarding the importance of different aspects of participation.

16. I believe that indirect participation (that which does not involve directly contributing work) is an important element of prolonged group work:

- Strongly Disagree    Disagree    Neutral    Agree    Strongly Agree

17. Please indicate how important you feel it is for students to demonstrate the following things when participating in prolonged group work:

	Very Unimportant	Unimportant	Neutral	Important	Very Important
17a. Contributing work to the group:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17b. Communicating with other group members in a work-related manner:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17c. Communicating with other group members in a social manner:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17d. Remaining up-to-date with the overall status of the project and the work of other group members:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17e. Providing feedback on the work of other group members:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. What do you feel are the most important skills or qualities that a student must demonstrate when participating in prolonged group work?:

19. Please indicate how often you typically receive the following complaints from your students:

	Never	Rarely	Sometimes	Often	Frequently
19a. Group member not contributing work in timely manner, or not at all:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19b. Group member not communicating or remaining in contact with group:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19c. Group member contributions are of low quality, or of inappropriate length/content:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19d. Group member not remaining up-to-date on status of work and submissions of others:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20. What other complaints relating to prolonged group work have you received from students, if any?:

### Finish

If you wish, you can review previous sections by clicking the "<< Previous" and "Next >>" links - remember not to use your browser's back feature.

If you have **any further comments** you feel are relevant, please write them below.

Please **press the submit button** to submit your completed questionnaire.

Submit Survey

Thank you very much for completing this questionnaire and for supporting my research!



## Appendix K – Student Interview Script

This appendix presents the script of the semi-structured interviews administered to students. In each section of the interview, possible probing questions are indented beneath primary questions.

### GroupShare Usage & General Group Work

Briefly describe **what for** and **how much** you and your group used GroupShare...

How did this semester's group work experience **compare with previous group work**?

Was this experience **more pleasant than you had originally expected** it to be?

Do you feel this **was due to your group's usage of GroupShare** in any way? If so, how/why?

How did you and your group feel about the following **features** in GroupShare?

**The file statistics**, displayed when viewing a shared file (consists of a table showing how often and when each user has viewed, downloaded and commented on the file).

**The trophies**, displayed in your private workspace or user profile (consists of trophy icons awarded to users for participation-related activities and milestones).

I believe your group met **face-to-face** (f-2-f) on a weekly basis during the semester?

Did your group record work done during f-2-f meetings in GroupShare?

Did you **have GroupShare open during f-2-f meetings**? If so, **how was GroupShare used**?

Did **f-2-f meetings and work conflict with the Participation Awareness (PA)** feature?  
Please elaborate.

Do you feel that GroupShare and the PA feature **more useful for online-only groups**?

## The Participation Awareness Feature

Do you think the **PA feature influenced the way you worked in your group?** How?

Do you think it changed the way the **other people in the group** worked/participated?

Did your group **discuss the PA feature** at all? Please describe your discussion.

Did anybody in your group express a **dislike of the PA feature?** What didn't they like about it?

Do you think it made the group work more **competitive?** Why do you think this so?

Do you feel that this was a **good thing or a bad thing?**

Did anyone in your group try to **manipulate the PA feature** by spamming, creating noise, or gaming? How did they do this? **How successful** was it?

The PA feature makes an effort to **prevent manipulation by setting limits** on the number of actions which will gain points. For example, only a person's first three logins each day will gain them points.

Did these limits have a **noticeable impact on the PA feature** in your group?

Do you think that the limits helped to make the PA feature **more accurate?**

**How obvious** was it to when somebody in the group was trying to manipulate the PA feature?

Can you suggest any changes which would help the PA feature **detect and deter manipulation?**

Somebody who is determined to do so **will always be able to find a way to manipulate the PA feature** to some extent. Do you feel that this makes the **PA feature less useful?**

All **actions** performed in GroupShare – e.g. logging in, submitting a file or viewing a forum thread – have an **impact** on the PA feature.

Are there any actions which you felt had **too much or too little impact** on the PA feature?

Please explain **why** you feel this was too much/too little?

Do you think this was caused by having **too many/few "points"** given for the action, or by giving points for **too many/few occurrences** of the action?

Since the PA feature is **autonomous**, it has no "intelligent" way to assess the *quality* of contributions in GroupShare – The system cannot tell if you've uploaded a well written report, or last week's shopping list – and of course, depending on what the group is working on, last week's shopping list *may actually be* a high quality desirable contribution.

Therefore, the PA feature relies primarily on *quantities* of actions rather than their *quality*.

How did the issue of **quality versus quantity** affect how you felt about the PA feature?

Did you **take this issue into account** when looking at and interpreting the PA feature?

Do you see the PA feature's reliance on **mainly quantitative data as a "failing" of the PA feature** - something which makes it "less useful"?

How much use did you and your group make of the **rating feature** on files and forum threads? Why?

Would you have been more likely to use the rating feature in a **larger group**?

If it was used, did you notice the way the **rating of a file or forum thread influenced the points** awarded for it in the PA feature?

Do you feel that the amount of influence ratings had on the PA feature was **appropriate**?

Would you have liked the ability to **influence the PA feature by rating the accuracy of PA feature itself**? For example, to indicate that Joe Bloggs was not actually contributing as much as the PA feature was showing, or that Sue Smith was more active than the PA feature was showing.

**Which PA style did you use the most? Why?**

Do you feel that different PA styles gave you different information? Please elaborate.

Did the information from different PA styles ever conflict with each other?

Can you suggest any changes which would improve the presentation of the PA feature?

Do you feel that having multiple display styles made the PA feature more useful? Why?

**Overall**, how do you feel about the PA feature?

Do you feel that the **PA feature was accurate** for you and your group members?

**Was the accuracy of the PA feature an issue** in your group?

Did you find the **PA feature useful**? How so?

Do you think it made your group **work harder or better**? Please explain.

How do you think the PA feature could be **improved**?

Do you feel that a PA feature is a **worthwhile inclusion in a groupware system**?

## **Final Thoughts**

Were there any questions in either of the **questionnaires** which you found confusing or difficult to answer? [have "big" versions of questionnaires on hand if needed]

Was there anything which you felt the questionnaires could have asked, but **didn't**?

Is there **anything else** you would like to say about GroupShare, the Participation Awareness feature, or my research?

## Appendix L – Staff Interview Script

This appendix presents the script of the semi-structured interviews administered to staff members. In each section of the interview, possible probing questions are indented beneath primary questions.

### **GroupShare Usage & General Group Work**

*All references to students and units are in regards to the unit which participated in the research unless otherwise specified.*

How did your students respond to the fact that the unit required them to work in groups?

How does this compare with student responses in previous runs of the unit?

What tasks were your students required to complete as a group in your unit?

How did your students respond to GroupShare?

Did the student response to GroupShare change throughout the usage period? How?

Did any students discuss the use of GroupShare with you? If so, please describe the discussions.

Did your online students, if any, respond to GroupShare differently than your on-campus students?

How frequently did you see your students using GroupShare during the usage period?

Overall, how well did your students perform in their group work this semester, compared to previous runs of the unit?

Do you feel that using GroupShare influenced the way your students worked as a group? How?

Do you feel that using GroupShare resulted in higher quality outcomes from your students?

What did you use GroupShare, including the staff interface, for during the semester, if anything?

If used, was the staff interface able to do what you desired? Please elaborate.

Did you make use of the ability to view your students' groups? Why?

Are there any features or changes you feel could improve GroupShare or the staff interface?

## The Participation Awareness Feature

*It is likely that staff members will not have had any personal experience with the PA feature or even seen it in anything other than my demonstration. Examples of the 4 styles will be provided, in print or on a monitor.*

Which of the four PA styles do you find the most visually appealing? Why?

Which of the PA styles do you think provides the most useful information to *students*? Why?

Which of the four PA styles do you think provides the most useful information to *staff members viewing students*? Why?

All actions performed in GroupShare – e.g. logging in, submitting a file or viewing a forum thread – have an impact on the PA feature. As the PA feature is autonomous, it must rely primarily on the *quantity* of actions performed in GroupShare rather than their *quality*.

How does the issue of quality versus quantity affect how you feel about the PA feature?

Do you feel that this issue makes the PA feature inherently unreliable or inaccurate?

Would you consider using the PA feature to guide decisions relating to student participation in group work? e.g. determining if a student has been participating, or dividing marks between a group. Why?

During the semester, did you develop a perception of the dynamics/participation of any particular groups in your unit?

[nominate group to view PA feature of]

How does the PA feature reflect your own perception of this group?

## Final Thoughts

What are your overall thoughts regarding GroupShare as a tool to assist group work?

Do you feel that GroupShare is a useful tool to assist the type of group work in your unit?

Were there any questions in the staff questionnaire which you found confusing or difficult to answer? [have “big” version of questionnaire on hand if needed]

Was there anything which you felt the questionnaire could have asked, but didn't?

Is there anything else you would like to say about GroupShare, the staff interface, the Participation Awareness feature, or my research?

## Appendix M – Participant Demographic Data

Demographic data of participants was collected via consent forms (Appendix D). It has been reproduced below, to provide context to data presented in the thesis.

### *Pilot Study*

Participant #	Age Range	Gender	Study Mode	Nationality	Unit
1	< 21	Male	On Campus	Australian	P3
2	21 to 30	Male	On Campus	Australian	P1
3	< 21	Male	On Campus	Australian	P3
4	< 21	Male	On Campus	Australian	P3
5	< 21	Male	On Campus	Australian	P2
6	21 to 30	Male	On Campus	Kenyan	P1
7	21 to 30	Male	On Campus	African American	P1
8	< 21	Male	On Campus	Australian	P3
9	< 21	Male	On Campus	Australian	P1
10	31 to 40	Male	On Campus	Australian	P1
11	21 to 30	Male	On Campus	Australian	P2
12	< 21	Male	On Campus	Australian	P1
13	< 21	Female	On Campus	Australian	P1
14	> 50	Female	On Campus	Australian	P1
15	< 21	Female	On Campus	Australian	P3
16	21 to 30	Male	On Campus	Australian	P1
17	21 to 30	Male	On Campus	Australian	P1
18	21 to 30	Male	On Campus	Australian	P1
19	21 to 30	Male	On Campus	Australian	P2
20	> 50	Male	On Campus	Australian	P1
21	21 to 30	Male	On Campus	Australian	P2
22	< 21	Female	On Campus	Australian	P3
23	< 21	Male	On Campus	Indian	P3
24	< 21	Female	On Campus	Australian	P3
25	< 21	Female	On Campus	Australian	P1
26	< 21	Male	On Campus	Indonesian	P1

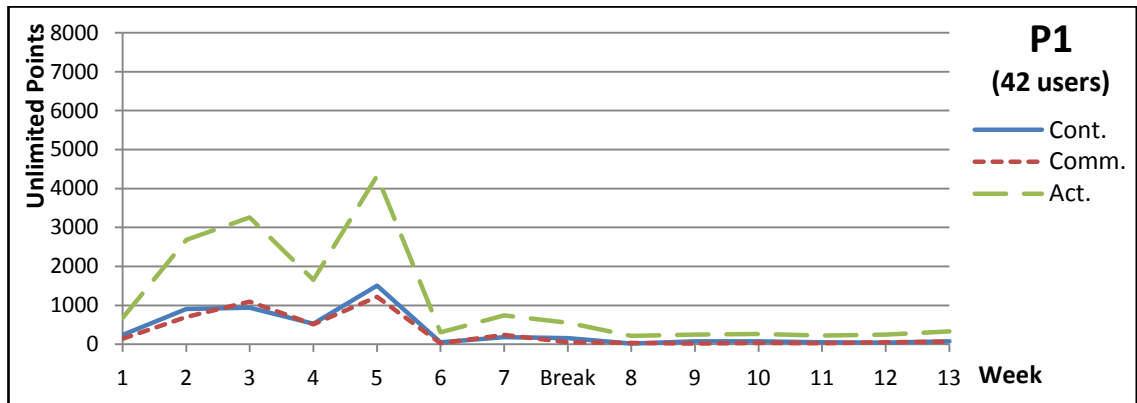
## Main Study

Participant #	Age Range	Gender	Study Mode	Nationality	Unit
27	41 to 50	Female	Online	Australian	M3
28	< 21	Male	On Campus	Australian	M2
29	31 to 40	Female	On Campus	Australian	M3
30	> 50	Male	Online	Australian	M3
31	< 21	Male	On Campus	Australian	M2
32	21 to 30	Male	On Campus	Australian	M3
33	< 21	Male	On Campus	Australian	M5
34	21 to 30	Female	On Campus	Australian	M5
35	< 21	Male	On Campus	Bosnian	M5
36	21 to 30	Male	On Campus	Australian	M3
37	31 to 40	Female	Online	Australian	M4
38	21 to 30	Female	Online	Australian	M3
39	31 to 40	Female	Online	Australian	M3
40	41 to 50	Female	Online	Australian	M3
41	31 to 40	Female	On Campus	Australian	M3
42	41 to 50	Female	Online	Australian	M3
43	> 50	Female	Online	Australian	M3
44	< 21	Male	On Campus	Australian	M3
45	> 50	Female	Online	Australian	M3
46	< 21	Male	On Campus	Australian	M2
47	21 to 30	Male	On Campus	Australian	M2
48	< 21	Female	On Campus	Australian	M2
49	21 to 30	Male	On Campus	Australian	M2
50	21 to 30	Female	On Campus	Australian	M3
51	> 50	Female	On Campus	Australian	M3
52	> 50	Female	Online	Australian	M3
53	21 to 30	Female	On Campus	Australian	M2
54	21 to 30	Male	On Campus	Australian	M2
55	21 to 30	Male	On Campus	Australian	M2
56	21 to 30	Male	On Campus	Australian	M5
57	21 to 30	Female	On Campus	Thai	M1
58	21 to 30	Male	On Campus	Portuguese	M2
59	< 21	Male	On Campus	Australian	M2
60	21 to 30	Male	On Campus	Australian	M2
61	< 21	Male	On Campus	Australian	M2
62	< 21	Male	On Campus	Australian	M3 & M5
63	< 21	Male	On Campus	Australian	M2

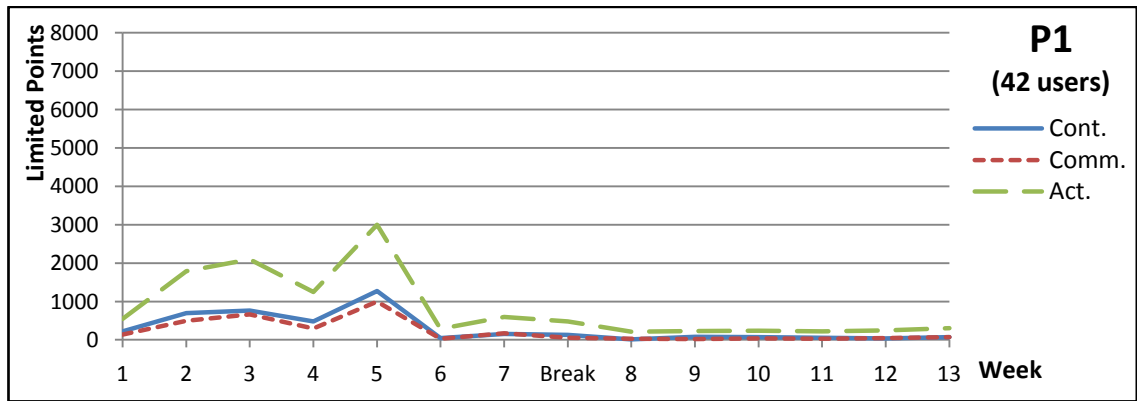
## Appendix N – Limited and Unlimited Unit Usage Graphs

In order to illustrate the effect of applying limits to the participation awareness mechanism, versions of the unit usage graphs presented in Chapter 5 are provided here with limits applied. The graphs of raw unlimited usage, as presented in Chapter 5, have also been reproduced, to facilitate comparison between the two versions.

**Unit P1, without limits**

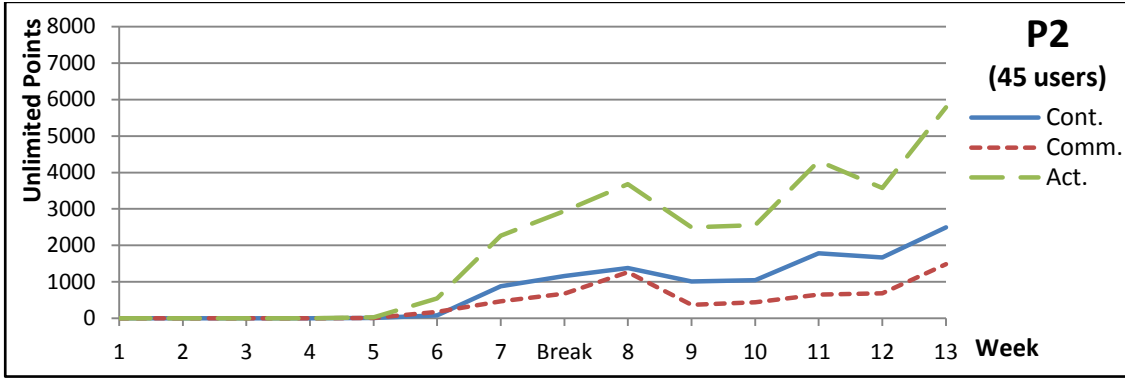


**Unit P1, with limits**

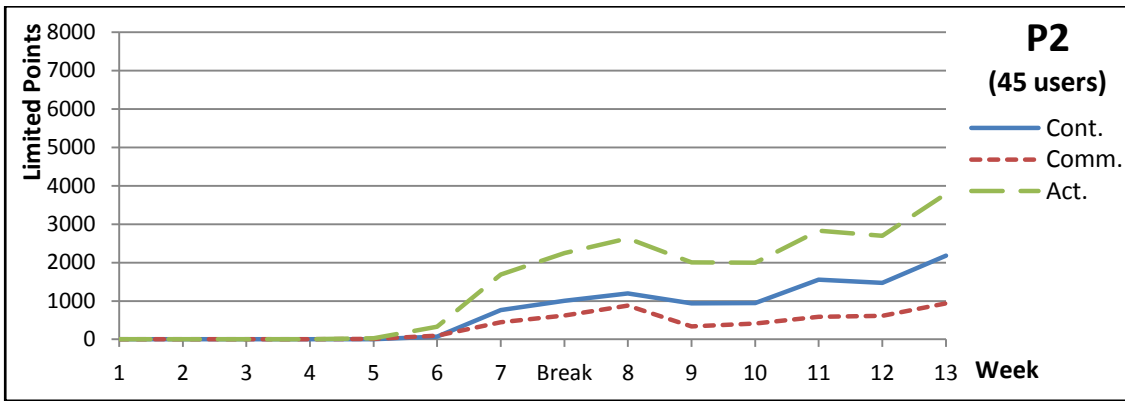




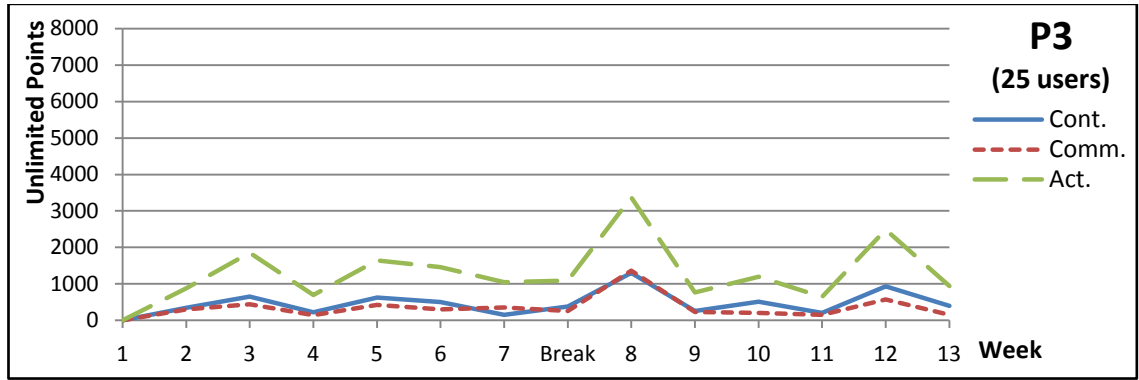
**Unit P2, without limits**



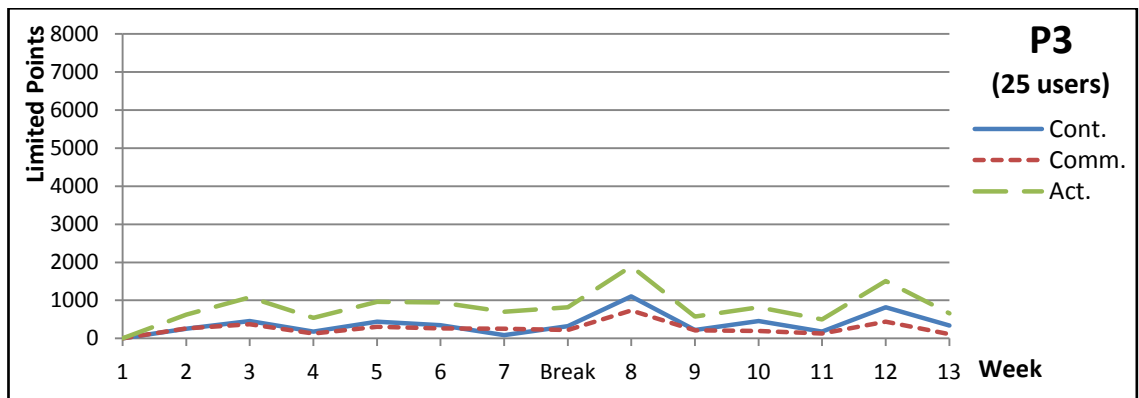
**Unit P2, with limits**



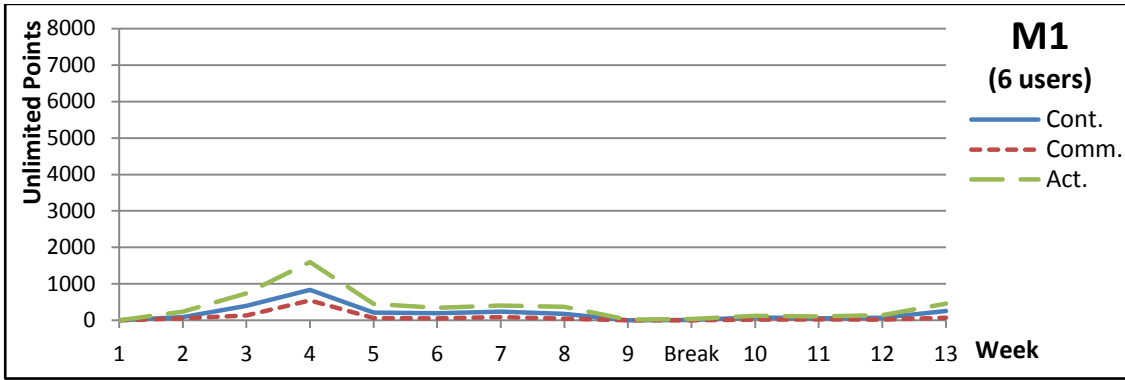
**Unit P3, without limits**



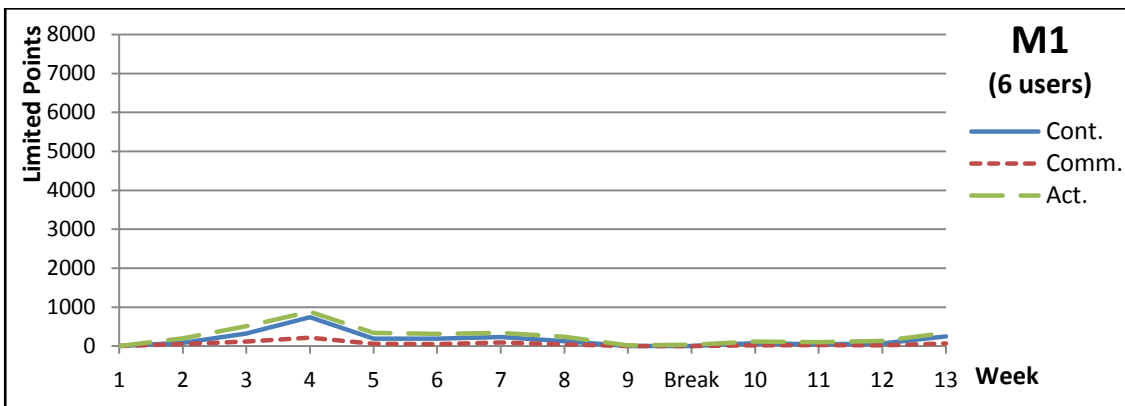
**Unit P3, with limits**



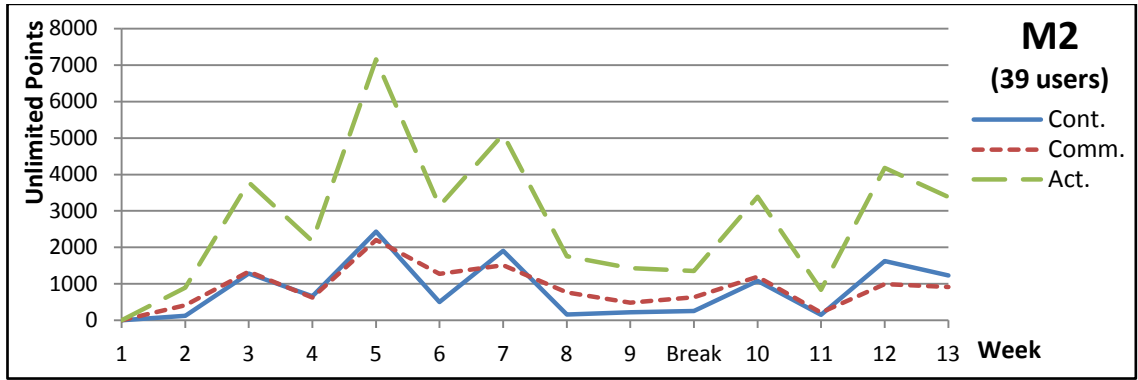
**Unit M1, without limits**



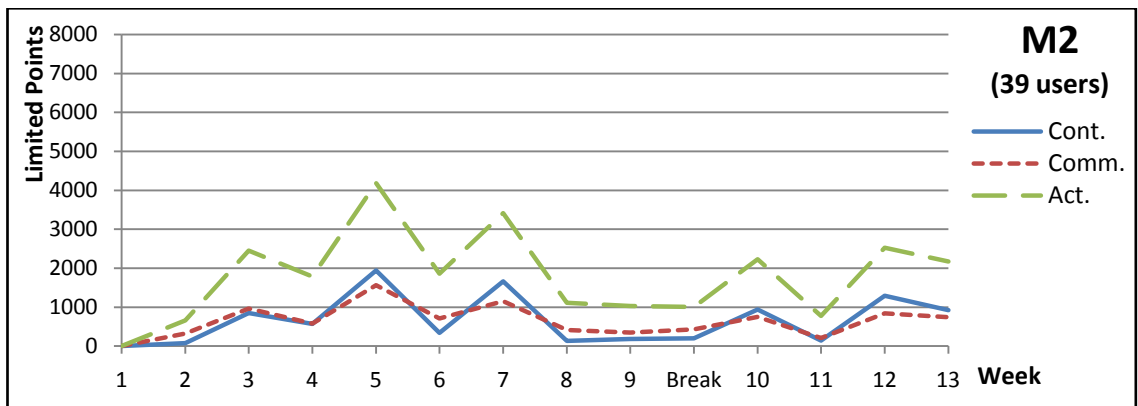
**Unit M1, with limits**



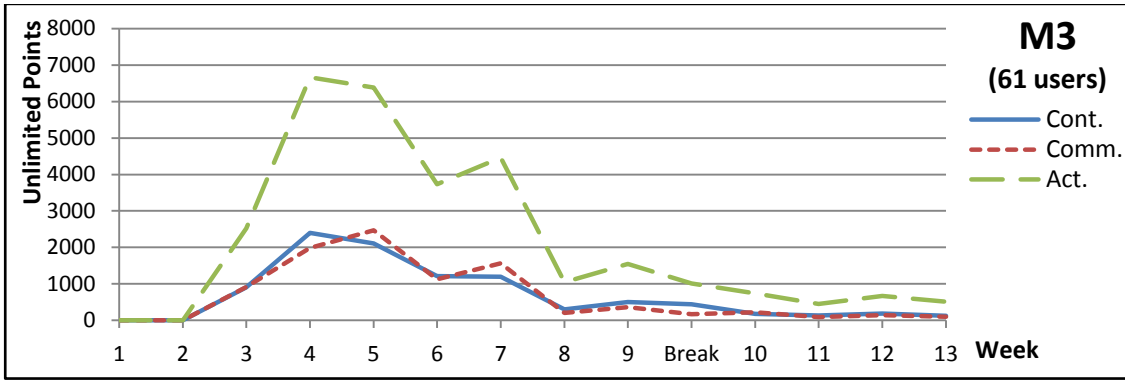
**Unit M2, without limits**



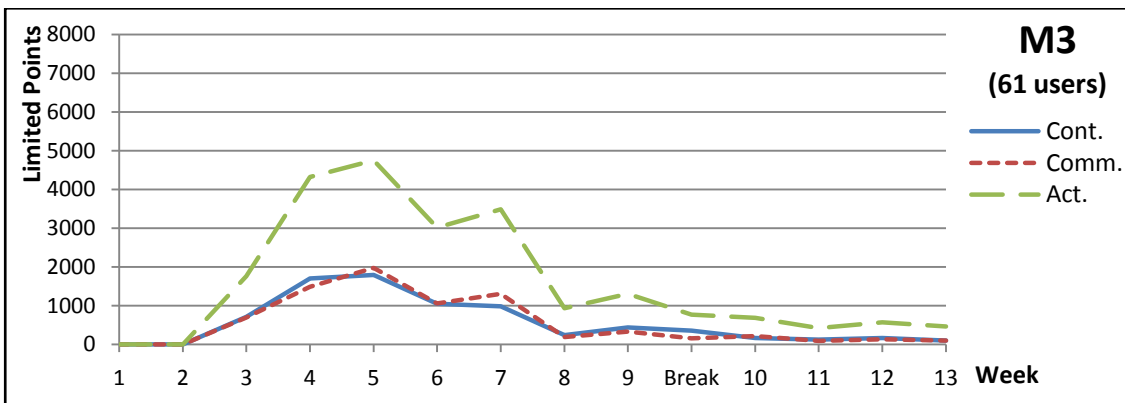
**Unit M2, with limits**



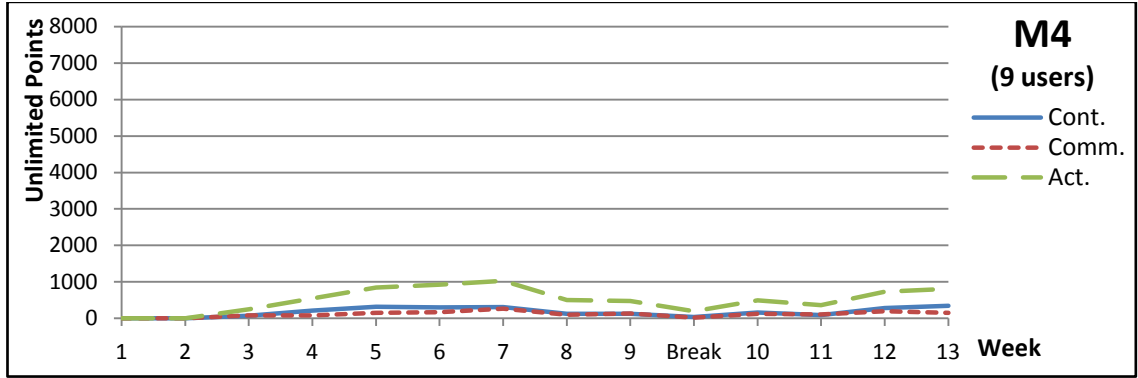
**Unit M3, without limits**



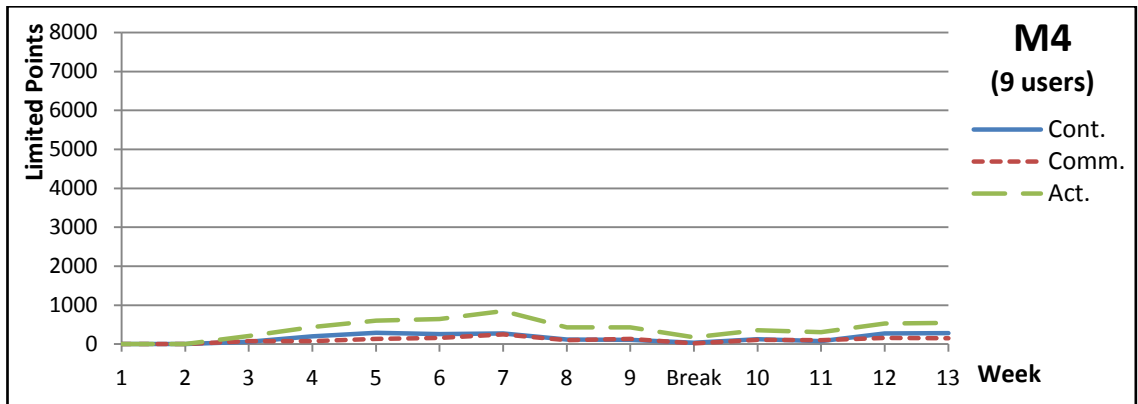
**Unit M3, with limits**



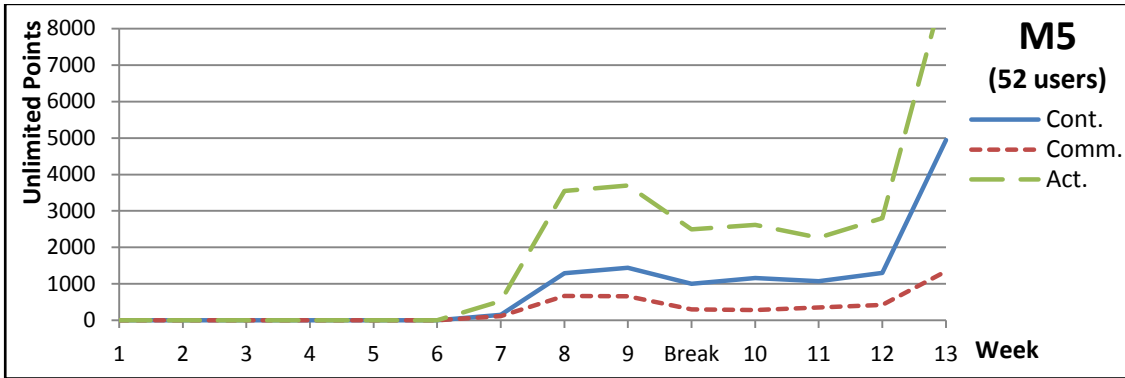
**Unit M4, without limits**



**Unit M4, with limits**



**Unit M5, without limits**



**Unit M5, with limits**

