Cloud-Based Communication Tools at Heriot-Watt University

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DECLARATION

I, Daniel Almaguer confirm that this work submitted for assessment is my own and is expressed in my own words. Any uses made within it of the works of other authors in any form (e.g., ideas, equations, figures, text, tables, programs) are properly acknowledged at any point of their use. A list of the references employed is included.

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ABSTRACT

This project investigates how currently available Cloud Based Communication solutions could improve online collaboration and communication between students and lecturers. By providing different tools for online collaboration, these cloud based services could potentially enhance the motivation of students towards a more effective collaboration within the University, thus, complementing their collaborative learning tasks and taking advantage of the already well established reputation of those tools among Internet users.

Offering students communication tools they are already familiar with could greatly enhance their participation and motivation in both educational tasks and sociable tasks, which according to research, is key to encourage users to participate in Computer Supported Collaborative Learning environments.

Students and lecturers were interviewed during the research in order to better understand their views on the current tools available at the University, as well as additional tools they use during their work for academic purposes.

As a conclusion to the research, a set of scenarios was developed in order to help students and lecturers find adequate tools for different stages of the teamwork process with the objective of enhancing their experience towards a better collaboration and thus, a better learning process aided by technology.
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To my parents…
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CHAPTER 1: INTRODUCTION AND OBJECTIVES

Heriot-Watt University has an established reputation for world-class teaching and a leading-edge research that identifies it as one of the top universities in the UK (Heriot-Watt, 2012).

The University has established and described its vision and strategies in a document called “Focus on the Future”. One of these strategies is the opportunity to improve studies, as defined specifically on the “Focus on Study” strategy, which inspires this project.

Students are the main stakeholder for a University, and providing better services for them and their lecturers, could potentially enhance their learning opportunities (Heriot-Watt, 2008).

The “Focus on Study” strategy states:

“Our virtual learning environment enables students to work at their own pace, interact with teaching and research staff and collaborate with peers in a structured and supported environment. We will continue to introduce the most up to date technology and new ways of learning in order to enhance the experience of our students, and create new learning opportunities. These developments will enable the university to provide the same high quality experience to students wherever they are studying and consequently will contribute to the global development and enhancement of our students’ experience.” (Heriot-Watt, 2008)

There is however room for extensive improvement in matters of the communication and collaboration tools that are currently offered in the VLE of the University (Vision), such as an old email interface, a practically unknown and out-dated calendar interface for students and discussion groups that lack usability, and most important, the out-dated version of Blackboard, the platform on which Vision is built into, to mention a few.

The opportunities to improve these tools have been pointed out by both students and staff in surveys conducted by the Academic Enhancement Department of the University (Kipar, 2011a, Kipar, 2011b), where among other features, users asked for improved usability, improved group management and an improved design.

This research seeks to investigate if free online collaboration and communication tools can improve the collaboration between students and lecturers in Heriot-Watt with the final objective to approach the vision of the University for the previously mentioned “Focus on Study” strategy.
1.1 AIM

To investigate and evaluate if Cloud Based Communication Tools can improve the collaboration between students and lecturers (student-student and lecturer-student) in their courses by enhancing the current tools available at Heriot-Watt University.

1.2 SPECIFIC OBJECTIVES

- To identify strengths and weaknesses of cloud-based communication solutions available for Educational Institutions.

- To investigate if cloud based tools currently available in the market can improve participation of students in Online Based Collaborative Systems.

- To identify the communications tools already available for Heriot-Watt students and lecturers and compare them to the solutions found.

- To determine if cloud based tools can motivate students to use them.

- To propose a series of scenarios for students and lecturers to consult in order to find appropriate tools.
CHAPTER 2: LITERATURE REVIEW

2.1 ONLINE LEARNING

Distance Education is summarized as a kind of education where the teacher and the learner are separated from each other, and where they get involved in a two-way interaction using technology as a communication medium, among which Online Learning can be found as a delivery method. Online Learning allows the participants (teacher and learner) to exchange resources in both synchronous and asynchronous ways by means of a communication network (Oncu and Cakir, 2011).

“Online Learning Environment is the system surrounding the learner and the teacher in terms of technical and social aspects.” (Oncu and Cakir, 2011, pp. 1098)

2.1.1 BLENDED LEARNING ENVIRONMENT

Blended Environment refers to the mixture of face-to-face and online learning environments and it is suggested by Roberts et al. (2010) that this approach is necessary in order to achieve greater use of a CSCL, the following are the main strengths and weaknesses from the perspective of the student of this approach identified by the mentioned authors in their research:

2.1.1.1 STRENGTHS

- Compatibility with working life.
- Suitability for different types of learners.
- Flexible learning times.
- Good student support.

2.1.1.2 WEAKNESSES

- Not enough guidance.
- Technical issues.
- Lack of communication.
- Poor use of online discussion tools.
- Unsatisfactory use of the face-to-face session time.

Furthermore, Roberts et al. (2010) also suggest that there are five key “ingredients” in a successful blended learning approach, which are: Live events, self-paced learning, collaboration, assessment, performance support materials with live synchronous events.
2.1.2 TEACHER’S INITIATION AND ASSISTANCE

“Initiation refers to the lecturer’s assistance and effort to establish students’ essential knowledge and develop required skills in the initial stage of a course, to initiate students into a particular field of study.” (Tsai, 2010, pp. 1138)

According to Tsai (2010), with teacher’s initiation the students have more chances to “climb their learning curves” when beginning a new course. The author suggests that teachers should initiate their students into the field of the course as findings have identified a higher involvement in online courses in these cases.

In their study, Oncu and Cakir (2011) identify the facilitator as a factor that affects the engagement, achievement and retention in Online Learning Environments, in other words, the way the facilitator treats the learners can influence how they comprehend the learning environment and act correspondingly.

Indeed, a functioning community requires significant input from all participants, however, Roberts et al. (2010) emphasise that the role of the academic tutor is critical as they have to achieve a balance between appearing overly directive or conversely neglectful. Thus, the authors point out that an effective CSCL requires significant input and direction from lecturers and suggest the “e-moderator” is an essential component in these learning environments.

Three kinds of presences that have implications for facilitation in a CSCL were identified by Oncu and Cakir (2011):

- Cognitive Presence: “The extents to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication”.
- Social Presence: “The degree to which a person comprehends another person as real.”
- Teaching Presence: “The design and interaction of the social and cognitive presences into the learning environment.”

From the previously mentioned types of presence, Oncu and Cakir (2011) identify cognitive presence as a vital element to critical thinking, which is constantly presented as a goal for all higher education, and therefore fostering cognitive presence as a facilitating method in OLE could be suggested as the most appropriate.
On the other hand, Kreijns et al. (2007) suggest that the development of social presence and a sense of online community become the key to promoting collaborative learning. The authors suggest that it is required to encourage and enhance online social interaction, which is the most important means to social learning because without it, social interaction does not occur. Moreover, social presence supports cognitive objectives by urging critical thinking, and affective objectives, by enhancing and making group interactions pleasant and rewarding.

2.1.3 LEARNING RESOURCES AND THEIR CLASSIFICATION

Learning resources are a fundamental factor to quality education, over the last decades, major changes in ideas about effective teaching methods and the availability and affordances of new resources with the aid of digital technology. The understanding of how to apply these new resources is still evolving and, in a sense, lecturers are in the position of learners in order to explore them (Littlejohn et al., 2008).

In their study, Littlejohn et al. (2008) identify a cyclic framework that describes three stages of learning associated with three types of resources: (1) Conceptualisation, learner sources new information or resources; (2) Construction, learner manipulates and works out how to use the resources; (3) Integration, learner develops resources and communicates them to the community.

In order to be effective, the authors recommend that resources need to follow the previously mentioned stages and enable the appropriate use of tools. Furthermore, the authors identify in their research twelve key characteristics shown by effective learning resources, therefore they suggest that resources are likely to have high usability if they have these characteristics.

2.1.3.1 TWELVE CHARACTERISTICS OF EFFECTIVE LEARNING RESOURCES ACCORDING TO LITTLEJOHN ET AL. (2008)

1. The materials can be easily sourced.
2. The resources are durable and maintained.
3. The resources have a degree of quality assurance.
4. The resources are free from legal restrictions.
5. The resources are available at an appropriate cost.
6. The resources are in formats that are accessible and ubiquitous.
7. The resources are in media that present intelligible representation in terms of language.
8. The resources are easily repurposed.
9. The resources are of a critical “size”.
10. The resources are presentable in a context that is meaningful for the practitioner.
11. The resources show how they will engage the learner.
12. The resources are reused in a range of educational models or learning designs.

2.1.4 SUCCESSFUL ONLINE RESOURCE CHARACTERISTICS

Implementing a CSCL is costly in budget and time/effort terms; therefore, the benefits of it must outweigh the investments the University made to implement it. By understanding and reviewing successful implementations, as well as pre-requisites, Benson Soong et al. (2001) have identified five characteristics or factors that may influence the success of a CSCL. These factors are described below.

2.1.4.1 HUMAN FACTOR

The activities and abilities of the course facilitator or lecturer correlate strongly to the success of the CSCL; these activities and abilities include: high human emotion interaction skills, high motivational skills and putting effort into making the resources interesting for the participants.

2.1.4.2 TECHNICAL COMPETENCIES

The computer literacy of the participants (both lecturers and students) is crucial for the success of the CSCL; otherwise, they will not make use of the resources as they lack the proficiency to handle them.

2.1.4.3 MINDSET

If the mindset of the participants is a constructivist approach, the usage, enrichment and enjoyment levels will be high. Otherwise, they will simply expect to “sit still and absorb”.

2.1.4.4 COLLABORATION

Students will have a higher learning if the course or the CSCL encourage collaboration for them to become active participants in the learning process.

2.1.4.5 IT INFRASTRUCTURE AND SUPPORT

If the IT infrastructure and the technical support for the CSCL are lacking or insufficient, the resources will not be well used due to its unreliability.
2.1.5 PARTICIPATION OF LEARNERS

“Online learner participation is a process of learning by taking part and maintaining relations with others. It is a complex process comprising doing, communicating, thinking, feeling and belonging, which occurs both online and offline.” (Hrastinski, 2008, pp. 1761)

In their study, Abedin et al. (2011) stress that an effective participation from the student is needed in order to consider the CSCL as fully utilised. Evidence suggests that the persistence of students to use new technologies is attributable to the confident use of applications available within the public domain, which supports the view that the socialisation approach is an effective enabler to increase participation. Also, uncertainty about how to communicate on an environment designed for educational purposes may be a barrier for its effective use gives an advantage to public domain tools since students are more likely to be familiar with them (Roberts et al., 2010).

In a research by Hrastinski (2008), he identifies six different levels of participation among learners, which are explained as follows.

Level 1: Participation as accessing e-Learning environments: Refers to the number of times the learner accessed the OLE.

Level 2: Participation as writing: Refers to the learner that writes many messages or many words.

Level 3: Participation as quality writing: Refers to the learner that makes writing contributions that are considered of high quality.

Level 4: Participation as writing and reading: Refers to the participation characterised by equally writing and reading in the OLE.

Level 5: Participation as actual and perceived writing: Refers to the learner that writes many messages that are perceived of importance in the OLE.

Level 6: Participation as taking part and joining a dialogue: Refers to the participation characterised by learners taking part and joining a rewarding dialogue.
2.2 COMPUTER SUPPORTED COLLABORATIVE LEARNING (CSCL) OR COMPUTER MEDIATED COLLABORATIVE LEARNING (CSML)

Computer Supported Collaborative Learning (CSCL) is defined by Wang (2009) as “an emerging research field that focuses on how collaborative learning, supported by technology, can enhance peer interaction and work in groups, and how collaboration and technology facilitate sharing and distributing knowledge and expertise among community members.”

Studies have found that students have reflected a higher level of confidence in communication with the purpose of creating a new body on knowledge through a CSCL and that lesson development through the Web helped students feel more enthusiastic about learning (Uzunboylu et al., 2011).

Computer-Mediated networks nowadays have enabled a shift in collaborative learning in contiguous learning groups to collaborative learning in asynchronous distributed learning groups, this, by the use of asynchronous and synchronous CSCL environments (Kreijns et al., 2007).

In their research, Kreijns et al. (2007), argue that an important factor that favour the use of asynchronous CSCL environments, is requirements of worldwide learning and life long learning, which fulfil the imposed requirements by both current and future demands on the knowledge society today. Additionally, Wang (2009) identifies collaboration work as a highly valued skill in today’s workplace, therefore, students can take great advantage if they learn how to work collaboratively in school in order to make the transition to the workplace less challenging.

2.2.1 COLLABORATIVE LEARNING

According to Wang (2009), many studies have demonstrated that group collaboration generally leads to better learning than individual work. The author also affirms that collaborative learning is not only “nice”, but it is “necessary for survival”. Other studies suggest that the key to collaborative learning is interaction between participants and collaborative learning activities (Uzunboylu et al., 2011).

There are two categories of social interactions in CSCL, the first one, known as on-task or pedagogical, refers to instructional and learning activities, for example, group learning and processing, whereas the second category, non-task or non-pedagogical includes activities which are not directly related to learning such as greetings, social support and making friends. The distinction between these two categories is essential; lack of non-task interactions has been related as one of the most important barriers in CSCL (Abedin et al., 2011).
It has been reported that collaborative learning promotes a more active and effective learning when used for distance education and that students using it have more constructive learning and higher grades than those in other conditions (Dewiyanti et al., 2007).

2.2.1.1 COORDINATING COLLABORATION

The coordination of the collaboration while groups go through the process of learning is key for CSCL according to Wang (2009). The author also suggests that in order to complete a task more efficiently, coordination should be supported by the CSCL.

2.2.2 CONSTRUCTIVIST LEARNING

The theory of constructivist learning suggests that students build knowledge in their minds, rather than transferring it from the teacher to the student, and Collaborative Learning is viewed as the main mechanism to learning as it enables students to articulate and clarify concepts, as well as to develop critical thinking (Altinay and Paraskevas, 2007), therefore it is suggested that the use of CSCL is recommended to foster the acquisition of complex problem solving skills (Clarebout and Elen, 2006).

Constructivism suggests that learning emerges as students interact with each other, collaborative learning is a learner-centred and team-oriented approach that requires learners to work together to accomplish learning goals, thus maximise achievement (Uzunboylu et al., 2011).

Online constructivist learning environments may encourage collaborative learning, however this may only happen if the participants are able to relate to each other and share a sense of community (Kreijns et al., 2007).

In order to develop critical thinking, Constructivist Learning pretends to enable high-order thinking, which occurs when a person interrelates new information with information already stored in memory and extends it to achieve a goal or find possible answers in a certain situation. High-order thinking requires a sustained critical discussion where disagreement is resolved through “the full cycle of the critical thinking process”, which is composed by the following steps (Altinay and Paraskevas, 2007):

1. Triggering-Posing the problem
2. Exploration-Search for information
3. Integration-Construction of possible solutions
4. Resolution-Critical assessment of the proposed solution
Students participating in a CSCL environment have the opportunity to take control over some of their learning and become active learners, which means they are not only absorbing new information, they are also connecting previous knowledge and new information to gain a deeper level of understanding (Dewiyanti et al., 2007).

### 2.2.3 COMPUTER MEDIATED COMMUNICATION (CMC) FORMS

Computer Mediated Communication, also described as Computer Mediated Discourse by Altinay and Paraskevas (2007), can take different forms in two categories: Synchronous and Asynchronous. In the synchronous category there are communication platforms like audio and video conferencing via web, while in the asynchronous category, belong tools like discussion boards, class listservs, emails, among others. The authors also mention tools that “lie somewhere in between” the two categories, such as chat rooms and Instant Messaging. The use of these tools support the findings of studies which suggest that an effective collaborative learning environment should offer adequate communication support, which is ideally in ways of text, voice, visuals, or a combinations of them (Wang, 2009).

It is suggested by Dewiyanti et al. (2007) that asynchronous tools are more suitable and effective for CSCL environments due to their flexibility in time to read, to reflect and to compose responses, therefore, is seen as a didactical approach that stimulates new learning. The authors support this suggestion with the result of their research, which indicates that students are generally satisfied with the use of asynchronous tools; however, it is important to note that they offer less flexibility by creating interdependence between the group members.

In the following sections, it will be discussed how and which category of tools is more appropriate.

#### 2.2.3.1 SYNCHRONOUS

Synchronous tools enable a social environment among participants, which addresses their feelings of isolation and detachment from each other. With real time interaction, enhanced group cohesion and sense of a “learning community” could be developed, which ultimately enhances motivation on the participants. Moreover, Altinay and Paraskevas (2007) point out that due to the interactions being fast-paced, dynamic and with a natural informality, the participants tend to be more honest, also, they engage more as a result of the degree of anonymity the environment offers, which allows them to have a perception of a “privacy zone”, thus, allowing them greater permission to speak and the immediacy of the feedback they receive from their peers and the instructor.
**2.2.3.2 ASYNCHRONOUS**

Asynchronous tools enable participants to interact, mainly, by posting messages or information in a communication platform at their own convenience, therefore, it is available during all day and everyday, allowing a higher degree of flexibility to the participants. This flexibility gives the participants more time for reflection and elaboration of each entry or response they produce. These tools are critical to the creation of learning, as they can lead to an elaboration of concepts and ideas from the discussions that can enhance the generalisation of facts as knowledge based in the situated understanding of the students (Altinay and Paraskevas, 2007).

**2.2.4 STUDENTS ENGAGEMENT AND MOTIVATION**

Student Engagement can be defined as the extent of the involvement of students and active participation in learning activities. There is however a disagreement on which category of tools is the best adequate to facilitate this engagement. Synchronous tools, as discussed earlier, offer rich interaction and immediate feedback, therefore, they emulate better a traditional face-to-face lecture, however it also brings its disadvantages, such as difficulties to offer all participants the opportunity to “be heard”, particularly, in text-based communication, those students may see their participation limited if, for instance, they are not quick writers, therefore, quick writers are the equivalent to “the loudest voice in face-to-face discussions”.

On the other hand, asynchronous tools give students the time to search for information, produce extended explanation, evaluate information thoroughly and ask elaborated questions, in addition to taking time to reach shared understanding to create their own ideas and formulate their own points of view. Furthermore, higher-order thinking and deep learning could be achieved using synchronous tools, however, it does not happen automatically; teachers need to ensure that students have correctly understood what is expected of them regarding when and how to collaborate (Altinay and Paraskevas, 2007).

According to Oncu and Cakir (2011), there are certain practices that lead to students having a high level of engagement with CSCL, as an example, the authors suggest interaction in OLE have implications on engagement and collaboration. Moreover, they associate online collaboration with a considerable improvement in both the volume and the quality of student’s involvement, satisfaction, engagement and high-order learning, and more importantly, the ability of individuals to think critically on group discussions in OLE through collaborative involvement, which also increase the productivity of the group as a whole.

In their research, Altinay and Paraskevas (2007) explain that student engagement involves the following three interrelated dimensions:
1. Behavioural Engagement, understood in terms of participation; this dimension can be observed in actions that lead the participant to specific outcomes, i.e. task completion. Retrieving data from the CSCL and analysing the log in times, system queries and general use of the platform, can measure this type of engagement.

2. Affective Engagement, the reaction of the students towards their teachers and peers and emotions that inform their actions. This can be assessed through expression of emotions during collaboration and the evidence of cohesion in the content of discussions.

3. Cognitive Engagement, which involves the time and effort students invest on processes like analysis that pave the way for cognitive change and growth. Cognitive Engagement can be assessed via a qualitative analysis of the interaction participants have in the collaboration to evaluate critical thinking.

### 2.2.5 Sociability

Communication between participants of asynchronous CSCL environments is mediated through the use of subsystems such as email, discussion forums, chat, etc., integrated within the CSCL environment, however, research has found that not in all cases, social interaction and collaboration are positive in these CSCL environments (Kreijns et al., 2007).

The social character in a CSCL is concerned with providing the conditions that will enable free, open and honest contributions between participants; however, studies have shown that enabling face to face contact among the participants before starting to use Online Collaboration, is a key to increase the frequency and frankness of exchanges among peers (Roberts et al., 2010).

According to Kreijns et al. (2007), support of social interaction aimed at cognitive processes for collaborative learning are the primary focus of educational researchers, as opposed to the support of social interaction aimed at the socio-emotional processes. Moreover, researchers assume that group dynamic processes will occur in CSCL environments, similarly to face-to-face settings, and they fail to study and support this group dynamics; therefore, functional CSCL environments are developed. This assertion is supported by Abedin et al. (2011), who claim that social aspects of CSCL are usually neglected or assumed to occur automatically by the sole creation of the learning environment and because of this, studies indicate that isolation and lack of sociability in the CSCL as emerging challenges to it and therefore, should be considered for future implementations.
The research involving CMC is mainly focused on cost, efficiency and productivity, with almost null attention to the effects the participants or the social relations created from the use of these technologies. This functional perspective is very limited, as Kreijns et al. (2007) noted, “forgetting, neglecting or ignoring social psychological processes such as group forming, establishing group structures and sustaining social relationships is considered a pitfall.” Social interaction is greatly related to the learning pleasure and effectiveness for the student (Abedin et al., 2011).

The authors argue that the participants are not just there to processes the information given to them, but they are social beings, therefore, not only are they looking for information, they are also seeking affiliation, support and affirmation. To be able to contribute to the development of effective online communities, the environment given to the participants must offer them the tools to communicate social cues and information.

Following the previously mentioned arguments, the authors suggest that what is really needed, are sociable CSCL environments that offer educational functionality, as well as social functionality in order to fulfil the student’s both their learning needs and social needs, thus, making a complete learning experience. Simply introducing the students to computer supported environments with different advanced technological features does not mean that this would lead them to productive collaboration and social interactions, instead, careful investigation is needed in order to analyse the sociability of the CSCL and determine the degree to which it can provide a non-task environment for sociability (Abedin et al., 2011).

Sociability is defined as “the extent to which a CSCL environment is perceived to be able to facilitate the emergence of a sound social space.” where social space is the “sound” if it is to be characterized by “affective work relationships, strong group cohesiveness, trust, respect and belonging, satisfaction, and a strong sense of community”, sociability therefore, is determined by social affordances, which must be integrated in CSCL environments (Kreijns et al., 2007).

The authors give the following analogy in order to better explain social affordances:

“In order to clarify the concept of social affordances a canonical example of a real life social affordance device is given here. The water cooler is a place where people gather and have casual conversations and communicate informally with each other. These impromptu encounters offer serendipitous moments to exchange not only task related information but also socio- emotional information. The water cooler becomes a place where people can get to know each other and experience whom they can trust, who the experts are, what the interests of others are, and so on.”
To conclude their research, Kreijns et al. (2007) point to social interaction in group learning as the responsible for well performing groups in which an affective structure is established, which is characterized by social relationships, social cohesiveness and a sense of community, which ultimately, are the features of a social space. Additionally, in order to implement a technologically, educationally and socially functional CSCL, the perspective of the participants needs to be taken into account in addition to that of the designer.
2.3 CLOUD COMPUTING

In the last years, computing has rapidly grown and being transformed to a model that consists of services that are delivered in a manner similar to traditional utilities, such as water and electricity, among the paradigms that follow this tendency, is Cloud Computing, which refers to the infrastructure as a “Cloud”, where users can access applications in whichever location they are on demand, therefore, the computing world is quickly transforming towards developing software for millions of users to consume as a service, rather than a product that runs individually in each user’s computer (Buyya et al., 2009).

According to Weinhardt et al. (2009), there is yet to be an established definition of “Cloud Computing”, and this leads to scepticism and/or overestimation on its impact in the technology and business landscape. Alternatively, Buyya et al. (2009) propose a definition on their paper based on their observation of the essence of what Cloud Computing promises to be: “A Cloud is a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumers.”

Consumers are attracted to this new model by the potential of reducing or even eliminating costs that involve having these services hosted “in-house”, especially small businesses with limited resources, see great advantage in this model, as they no longer need to make big investments to have and maintain IT infrastructure, however, there are implications of using cloud computing; customers must have guarantees from the providers to ensure service will be delivered when needed, as they might be crucial for business operation; a Service Level of Agreement (SLA) is usually negotiated between provider and consumer in order to provide this guarantee, which also include parameters of Quality of Service (QoS) (Buyya et al., 2009).

Moreover, Cloud Computing offers considerable opportunities to businesses, there is not need for up-front infrastructure investment, investment in software licenses and no risk of unused software that has already been paid for, as well as hardware infrastructure and maintenance and staff related to it. In general, users of Cloud Services only pay for the IT resources they actually use, and they only use what they actually need; at the same time, another advantage is scalability and flexibility, as it enables easy and fast scaling of the IT resources required on demand (Stanojevska-Slabeva and Wozniak, 2010).

Cloud computing is expected to be a $160-billion market, of which $95-billion will correspond to business and productivity applications and another $65-billion to online advertising (Buyya et al., 2009).
2.3.1 THE CLOUD BUSINESS MODEL FRAMEWORK

The Cloud Business Model Framework (Figure 1) proposed by Weinhardt et al. (2009) is categorized in three layers: the infrastructure layer, the platform-as-a-service layer and the application layer, a brief description of each is detailed below:

- **Infrastructures in the Cloud**: The infrastructure layer comprehends business which main objective is to provide technologies that enable basic components for the necessary ecosystems of cloud computing. Usually, these infrastructures are organised in a cluster-like structure, which facilitate virtualization technologies.

- **Platforms in the Cloud**: Represents solutions on top of a cloud infrastructure that provides value added services from a technical and business perspective. They enable developers to write applications and upload the code into the cloud, where the application is accessible and can be run in a web-based routine. Google App Engine (not to be confused with Google Apps) is a popular example of this solution.

- **Applications in the cloud**: This layer represents the actual interface for the customer, therefore is what end-users commonly interact with and get to know from Cloud Computing. Also known as Software-as-a-Service (SaaS) applications, they differ from rudimentary Web services on-demand. A popular example of SaaS is the Google Apps Suite, which consists of an office suite (word processor, spreadsheet, calendar, etc.) accessible through a web browser.
2.3.2 CHALLENGES OF CLOUD COMPUTING

As mentioned before, Cloud Computing could represent potential cost reduction for businesses, but it also depends on Quality of Service and accessibility for it to deliver results as expected, therefore the user has to rely entirely on the provider with respect of reliability, performance and QoS; these however, are not the only challenges that can be faced when adopting this services.

Clouds serve usually many different customers, therefore, users do not know who else is running their business in the same server as them, moreover, typically, the Cloud is outside the company’s own firewall, which can impact significantly on an organisation’s decision to adopt Cloud services (Stanojevska-Slabeva and Wozniak, 2010).

In their paper, Stanojevska-Slabeva and Wozniak (2010) identify security and privacy risks related to data storage and management due to the need to transfer data back and forth for processing to the Cloud, and because the data is stored on an external infrastructure, companies rely on the provider to ensure no unauthorized access is given; the authors also describe availability, security, performance, data lock-in, data confidentiality and auditability,
data transfer bottlenecks, ability to integrate with in-house IT and lack of customisability as some of major risks in using Cloud Computing in an organisation.

2.3.3 SWOT ANALYSIS

In their research, Marston et al. (2011) carried out and proposed a SWOT analysis for their investigation, which presents a business perspective of Cloud Computing, the SWOT analysis is summarized below.

2.3.3.1 STRENGTHS

• It offers the ability to scale up services on the fly, which obviates the need for servers which are underutilised in anticipation of a peak demand; when the organisation requires an unanticipated demand above its capacity, it has the ability to request more resources automatically, therefore, effectively using time-distributed computer resources.
• Maintenance costs become much more simple.
• A simple web-based interface manages when, where and how employees have access to computer system’s within the organisation.
• Employees are able to fully use the systems of the company using less powerful devices such as smartphones, tablets or netbooks, as they do not require to be processed locally.

2.3.3.2 WEAKNESSES

• Organisations are justifiably cautious of the loss of physical control over the data transferred to the cloud.
• Large organisations need to be careful of entrusting critical applications to a cloud provider where they cannot commit to the QoS and availability that are demanded and needed.

2.3.3.3 OPPORTUNITIES

• There is a significant opportunity to take advantage of Cloud Computing in developing countries, where it can help them reap the benefits of IT without making significant investments.
• Similar to developing countries, small businesses can exploit high-end applications without significant investments.
• Mashups, web pages or applications that combine functionalities from more than one external source and create a new original one in unintended way.
• Using Cloud Services could allow organisations not only to reduce their IT infrastructure, but since transporting computer services is cheaper than energy, it could also represent a smarter use of energy.

• Finally, the authors believe that the Cloud today shows the characteristics of a disruptive technology, that is, an innovation that upsets the existing order of things, usually lower-functionality innovations that appeal to users who are not currently served by the industry, however, they suggest that innovative services that will be developed in the Cloud will soon make applications functionality richer than their in-house counterparts.

2.3.3.4 THREATS

• Possibility of a negative reaction from entrenched existing IT department employees, who may view it as a threat not only to their corporate IT culture in terms of data security, audit policy, etc., but also in terms of job security.

• Possibility of cloud providers to go bankrupt.

• Security as a concern to IT executives, which is reported to be their primary concern in surveys.

• Lack of standards, where companies might force customers into locked and proprietary systems that in the end will cost more.

• Regulation at local, national and international level, which can range from data privacy and access, to audit requirements and data location, e.g. some nations have laws that require providers to keep data within national borders.
2.4 ONLINE COLLABORATION TOOLS

This section reviews some of the tools available online that can be used by students and lecturers to improve their communication.

It is important to note that the tools mentioned on this document are only few of the options available, however, they were chosen due to their popularity and mentions during the research for this investigation, particularly, interviews to students and staff at Heriot-Watt University.

2.4.1 DROPBOX
Dropbox is a free service that offers users cloud storage to upload any files. The storage capacity is initially of 2GB, however, users can increase this space in two ways: the first one is via referrals, users can send invitations to their contacts, and for every contact that joins the service, an additional 500MB is awarded; the second option is paying a monthly fee (Dropbox, 2012).

The biggest feature of this service is the ability to install a small application on the user’s computer, smartphone or tablet that allows synchronization of all the files in the user’s account. In the case of computers, the application adds a folder in the user’s hard drive where he/she can simply create or transfer files using the file explorer as if it was a regular folder on the hard drive.

2.4.2 GOOGLE APPS
Google Apps is a suite of online applications offered by Google to all users with a Google Account. The suite consists dozens of applications, however this paper reviews only those that are relevant to the research.

2.4.2.1 GOOGLE MAIL
Google Mail (Gmail) for education offers to each user 25GB of storage, as well as implementing a powerful spam filter, a 99.9% SLA, voice/video conferencing and IM chat (Google Talk) which can be accessed on the mail page or by desktop and mobile clients and third-party clients. Gmail is also compatible with Outlook, Blackberry and other popular email clients, including mobile OS’s as it can be used via the IMAP or POP3 protocols, which makes it widely compatible to virtually every client. The Gmail interface can be customised with the school’s logo, colours and domain, and maintains the already known popular Gmail functionality, which also does not include any ads (Google, 2012a).
2.4.2.2 GOOGLE CALENDAR

Google Calendar enables users to easily schedule, share and organise events; it is integrated with Gmail for easier access and management and can also be accessed via popular clients like Outlook, iCal, Android OS and iOS, keeping calendars synched. Schools can also publish events for all users to see and add to their own calendars (Google, 2012b)

2.4.2.3 GOOGLE DOCS

Google Docs is a web-application that allows users to create, share and edit documents, spreadsheets, drawings and presentations in real-time via a web browser. Users can open their documents easily and quickly without the need of external USB memories or email attachments that can become out-dated and confusing when managing a large number of versions. Google Docs gives administrators of the file controls to manage file permissions and because it runs in a web browser it can be accessed in almost any computer and many mobile devices without the need of additional software. Documents also have a commenting feature and revision history that facilitates feedback among participants (Google, 2012c).

As of the summer of 2012, Google launched Google Drive, a service that manages the user’s documents, therefore, if the user activates this new service, which at the time of writing this document, is optional, the two services will be integrated into one (Google, 2012d).

2.4.2.4 GOOGLE DRIVE

Google launched this new service in the summer of 2012, and it is a direct competitor of the previously mentioned Dropbox, offering the same features with the difference of giving 5GB of free storage (Google, 2012g).

Google Drive can be accessed via a web browser, and has the advantage of easily sharing files with other Google users, specifically documents, which can be directly opened into Google Docs for real-time collaboration without needing to download and open the file using a word processor.

2.4.2.5 GOOGLE GROUPS

Google Groups allows users to create and manage their own group and set up mailing lists, share documents, sites, calendars and more with other users. Groups also let users to customize their subscription settings to receive mailing lists as a digest or by browsing the web to avoid receiving a big amount of emails. Other features include searchable archives, APIs that allow integration with course management systems (Google, 2012e).
2.4.2.6 GOOGLE HANGOUTS

Hangout is a new service by Google that allows users to make video-calls with other Google users within the web browser. The service allows up to ten users in one “hangout” and it only requires the installation of a small plugin in the computer.

Hangouts offer a few features within the video-call to enable collaboration, these features include: sharing the user’s screen to the other participants, sharing documents on Google Docs for real-time collaboration, and sharing websites.

Hangouts can be started from Google’s social network: Google+ or directly from Gmail; additionally, users can join or create a Hangout in their smartphone or tablet via the Google+ application (Currently only available to Android and iOS) (Google, 2012f).

2.4.3 SKYPE

Skype offers users three different services: voice-calls (Skype-to-Skype and Skype-to-phone), video-calls and Instant Messaging; however, it is mainly recognized for the popular video-calls.

The service provided by Skype is free of charge, with the exception of calls to regular phones; users only need to install the application on their computer and create an account. Skype also offers client versions for popular smartphones and tablets.

Another feature provided by Skype is the ability to create videoconferences or group video calling with up to ten users; this feature was recently added to Skype, however, it is not free of charge for users as it requires a premium service currently priced at £5.99 per month, which includes other features like group screen sharing, live customer support via chat, unlimited calls to phones in a country of the user’s choice and an ad-free service (Skype, 2012).

2.4.4 DOODLE

Doodle is a free service that offers users an easy way of scheduling events with colleagues where the user sends a poll to them indicating the proposed dates and times, then, each participant will select their preferred choice. The result can be seen by the user in order to decide when to schedule the event.

Doodle does not require users to register to use the service, however, if they decide to register, it offers a extended features, such as connecting to their calendars to automatically add the events; Doodle has the ability to connect to the most popular calendar services like Google Calendar, iCal, Outlook, and others (Doodle, 2012).
2.4.5 FACEBOOK

Facebook is arguably the most popular social network nowadays, and while its main purpose is not collaboration, students and lecturers interviewed for this research mentioned in several occasions as an easy alternative of communicating with colleagues.

The feature relevant to this investigation is the messaging tool, which provides an Instant Messaging-like experience, and can be accessed via any web browser or as a stand-alone application for a few smartphones. Facebook private messages have the characteristic of letting the sender know when the receiver opened the message, a feature that at the time of writing this document, cannot be switched off.
CHAPTER 3: RESEARCH METHODOLOGY

In order to answer the research objectives of the project (explained in the “Objectives” section of this paper and reviewed again later in this section) a set of activities to gather data was conducted. Data gathering is one of the most important parts of the project; its purpose is to collect sufficient, relevant and appropriate data in order to have enough and accurate information from the participants and other stakeholders (Preece et al., 2002).

It was also important to identify the stakeholder groups of the project to be sure to analyse all the information needed to conduct the research, if an important stakeholder group is overlooked, it could lead to inconsistencies in the data, producing unreliable results (Preece et al., 2002). The stakeholders identified are: students, lecturers and IT Services staff.

To choose between the different data gathering techniques available, the following guidelines were followed based on the studies by Preece et al. (2002):

- Focus on identifying the needs of the stakeholders.
- Involve all the stakeholder groups.
- Involve more than one representative from each stakeholder group.

After reviewing these guidelines, a qualitative research method was selected to be the most suitable for the project. The following section explains this decision.

3.1 ONTOLOGY

Ontology is a branch of philosophy that studies the nature of social phenomena as entities; it is divided in two views or positions: Objectivism and Subjectivism.

Objectivism argues that social entities exist in reality external to social actors; this means that social interaction does not affect the views of the person. Subjectivism on the other hand, debates the opposite, that is that social phenomena are created from the perceptions and consequent actions of social actors, it is a continual process that through the social interaction, these phenomena are in constant revision (Saunders et al., 2009).

For the purposes of this research, the aspect of subjectivism was followed due to the intention to understand how individuals perceive different situations in which they interact at the University, more specifically, collaboration and communication situations.
3.2 EPISTEMOLOGY

Epistemology refers to what constitutes acceptable knowledge in the field of study, as well as what is valid in the generation, understanding and use of knowledge (Saunders et al., 2009) (Wahyuni, 2012).

Epistemology is categorized in four philosophies: positivism, realism, interpretivism and pragmatism. This research follows the interpretivism; Saunders et al. (2009) argue that positivism has an important downside, which is that rich insights into a complex topic are lost if that complexity is minimised to a series of generalisations; an argument with which this research sympathises. Interpretivism on the other hand, support that it is necessary for the researcher to understand the difference between humans in their role of social actors. The researcher needs to adopt an empathetic stance, and literature points out that situations like behaviour are complex enough to be unique, therefore recommending this philosophy as the best suited for behaviour research (Saunders et al., 2009).

3.3 GROUNDED THEORY

Grounded Theory is a term that responds to the debates about the vale of qualitative analysis as opposed to quantitative. This theory was developed in an inductive manner by inspecting sources like unstructured interviews and observational data. Nowadays, the term has extended to the point of including the methodology involved in developing the theory, and the theory itself.

The process of Grounded Theory involves an iterative process where theoretical insights are discovered in the data, then, those insights are tested to validate how they can relate with other parts of the data, later on they will produce their own theoretical insights, which again are tested against the data. Therefore, even when this method is inductive, deduction is used as well in many parts of the process. In the end, what is produced from using this method is precisely what the name suggests: theory that has been firmly grounded in observation of reality, not theory that has been developed because it seems to be logical (Hayes, 2000).

It is this last reason why Grounded Theory was selected for this project; the goal of the research is to understand and identify the issues in the way users (students and lecturers) use collaboration tools to then compare with the available literature and create a set of scenarios that users can use to find the tools adequate for a certain phase of their collaboration activities in the University.
Finally, Hayes (2000) explains that Grounded Theory work has three types of outcome: (1) taxonomy development, which refers to the use of grounded theory to identify a practical set of concepts which can form a basis for further research; (2) local theoretical reflection, which indicates using the analysis to explore issues relating to a particular event or circumstances; and finally (3) fully-fledged grounded theory, which is an attempt to develop a full account of the topic being investigated, incorporating enough depth and detail that it can be treated as a full explanation and used as the basis of future research.

This research has a taxonomy development outcome, as it analyses the literature and data from interviews and attempts to create a set of scenarios and recommendations, which can be the basis for new research on the subject, few of which are discussed at the end of this document.

3.4 QUALITATIVE ANALYSIS

Qualitative Research emphasises validity, as opposed to reliability, a feature often related to quantitative methods. The goal of a researcher using qualitative analysis is not to produce results that can be replicated, but instead, to truly understand what is happening; it provides richer information about the topic, as it allows avoiding relating human activities as a “simplistic, robotic action without motives” (Hayes, 2000); Using this method allows to identify the complexity of those actions, therefore, gaining a much deeper understanding of the topic (Hayes, 2000).

3.4.1 THEMATIC QUALITATIVE ANALYSIS

The data gathered for the research was sorted into themes, as suggested by the Thematic Qualitative Analysis Framework. The themes consist of recurrent ideas and topics found on the analysed material.

The data analysis was done with the use and support of a Computer Aided Qualitative Data Analysis Software (CAQDAS) in order to facilitate the structure of the data, the closeness to the data, the exploration of the data, the ability to code and retrieve relevant information, organising data, searching and having a cleaner output of the material (Saunders et al., 2009).

The first phase of the project involved interviews with students and lecturer, all from Heriot-Watt University.

The second phase consisted of an analysis and comparison of the data obtained from the interviews and the literature review, to conclude the research, a set of scenarios were
produced to better demonstrate situations where Online tools can be used for collaboration and communication.

The following subsections explain Interviews and why this data gathering technique was chosen to answer these research objectives:

- To identify strengths and weaknesses of cloud-based communication solutions available for Educational Institutions.
- To investigate if cloud based tools currently available in the market can improve participation of students in Online Based Collaborative Systems
- To identify the communications tools already available for Heriot-Watt students and lecturers and compare them to the solutions found.
- To determine if cloud based tools can motivate students to use them.
- To propose a series of scenarios for students and lecturers to consult in order to find appropriate tools.

3.5 INTERVIEWS

Interviews involve asking the participants a set of questions, and can be structured, unstructured or semi-structured, depending on how rigorously it will follow the prepared set of questions (Preece et al., 2002). This technique was chosen for the research because they are singularly efficient at getting the participants to explore issues, particularly in the first phase in the form of a semi-structured interview, where the research intends to draw out scenarios the participants identify as important in the Collaborative Learning Environment. Additionally, interviews often encourage people to respond due to the interaction with a human rather than an impersonal questionnaire, as they feel more involved in the process (Preece et al., 2002).

Disadvantages of interviews relate to them being time consuming (Preece et al., 2002), however for the purposes of this research, all the participants were located in the same area (Heriot-Watt University), which made meetings feasible, therefore, it did not impact drastically on the project. On the other hand, time did play a role as a disadvantage, as the research was performed during the summer, the amount of available participants was drastically lowered.

3.6 PROFESSIONAL, LEGAL AND ETHICAL ISSUES

This section explains the professional, legal and ethical measures that will be taken into practice for this research. All the information and measures explained are based on the guidelines suggested by Preece et al. (2002).
Due to the nature of this project, it will require contribution from external participants by way of interviews and focus groups as discussed previously. Therefore, it is important to clarify that all the information collected from these activities, including the identity of the participants, will be kept strictly confidential during the development and after the completion of the project.

After the data has been analysed, the results of the analysis will be included in a processed form in the final documentation of the project, however, these processed data will not contain any information that can identify the participants and it will only show the overall results of the activities the participants performed.

Finally, the author of the project and the supervisor will keep, for reference purposes only, all information about the participants, as well as raw data from the activities, however the information will be treated as confidential and will not be disclosed to any third party or external person outside to the two persons previously mentioned without the authorization of the participants.

The participants will be given a consent form to sign explaining the previously mentioned privacy information, explaining as well they can withdraw from participation at any moment should they decide to do so without penalties.

Other guidelines to be followed are:

1. Telling the participants the goals of the research and what they should expect if they participate.
2. Explain the participants that sensitive information, such as demographics, financials or health are confidential.
3. Use a coding system to record each participant, if follow up communication with the participant is needed, their details will be stored separately from the data.
4. Quotes or descriptions that could reveal the identity of a participant will be avoided, if a quotation is needed, the participant will be asked for permission in advance, once again ensuring their anonymity and offering them a copy of the report before its distribution.

3.7 PARTICIPANTS

As it was mentioned previously in this chapter, the time when the research was conducted played as a disadvantage in order to find an extensive amount of participants, as the requirements to participate were somewhat particular.
There were two categories of participants, lecturers and students; students needed to be taught postgraduate students who had at least done one teamwork assignment during their course; while the lecturers category was more open, participation was expected to be lower, as many of them are on holiday during the summer. Additionally, professors and students needed to be from Heriot-Watt University, Edinburgh Campus.

Two invitation emails were sent, one to the MACS School Student Postgraduate mail list, and the other one, to the MACS School academic staff mail list. Another method to invite participants was by approaching students and lecturers directly on Campus.

A total of eight interviews were conducted, five with students and three with lecturers, all of which were voice-recorded and later transcribed. Additionally, as it was mentioned in the previous section, all participants were handed a consent form to sign along with a copy of the form for their own records, which can also be found in the Appendix section of this document.

Interviews, as mentioned earlier, were conducted in a semi-structured form, where a script was prepared to follow as a guideline, however, both interviewees and interviewer had more freedom in the way questions were answered and asked. It involved questions that were phrased in a way that allowed participants to answer in a more open manner but being careful enough not to get off topic. Both categories of participants had their own interview script, which can be found on the Appendix section.
CHAPTER 4: DATA ANALYSIS

This section presents a summary of the thematic data found on the data gathered via the interviews with students and lecturers.

As it was discussed in the previous chapter, due to the time of the year this research was done, there were not many participants available to interview, principally lecturers; however, the minimum expected interviews were done and sufficient data was collected.

The data has been divided in the main categories to be discussed, which are: Interest in Teamwork, Communication Issues, Applications or Tools used and Collaboration Process.

The criteria for the selection of participants has already been discussed earlier in this document in detail and the following data corresponds to the participants in order to distinguish each for the effect of this document, without disclosing personal information that may identify them (See Chapter 3 for details on Ethical Issues).

<table>
<thead>
<tr>
<th>Lecturers</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Howard</td>
<td>School of Management and Languages (SML)</td>
</tr>
<tr>
<td>Penny</td>
<td>School of Management and Languages (SML)</td>
</tr>
<tr>
<td>Tom</td>
<td>Mathematics</td>
</tr>
</tbody>
</table>

FIGURE 2: SAMPLE OF LECTURERS

<table>
<thead>
<tr>
<th>Students</th>
<th>Department</th>
<th>Age Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amy</td>
<td>School of Management and Languages (SML)</td>
<td>20-25</td>
</tr>
<tr>
<td>Lisa</td>
<td>School of Management and Languages (SML)</td>
<td>26-30</td>
</tr>
<tr>
<td>Mathew</td>
<td>School of Management and Languages (SML)</td>
<td>26-30</td>
</tr>
<tr>
<td>Jim</td>
<td>Computer Science</td>
<td>21-25</td>
</tr>
<tr>
<td>David</td>
<td>Computer Science</td>
<td>21-25</td>
</tr>
</tbody>
</table>

FIGURE 3: SAMPLE OF STUDENTS
4.1 INTEREST IN TEAMWORK

4.1.1 LECTURERS

From the lecturers interviewed, Howard and Tom mentioned they are not interested in teamwork assignments and have had negative experiences, such as: “Too many difficulties […] a group where people enrolled late, people missed a week […] what happened then was that the work that they submitted was not particularly good, but there were one or two people in that group who really I thought were quite good, they were pretty good students, and it turned out, their average mark grade was pulled way down by the average of the group, because the group just didn’t function as it should have done. […] That really kind of reinforced with me the reason why I don’t really use group work.”

Tom states: “We tried to make the experiment of maybe doing a team project for more than one students at the same time, we lowered the level of the project, and it didn’t work, the performance was, as expected, lower than previous years and it didn’t add anything to it. […] They copied each other and they were working in groups, but the strong people, they were the ones who did most of the work, whereas weak ones they just followed what the stronger did; in a sense, the weak students didn’t do any work at all.”

When asked if they thought this had to do with the subject, one of the answers was: “Sometimes you can have a topic that really just doesn’t land itself very easily to group work and I also believe that there is too much emphasis in group work within our department and within the school; during group assessment is fine, but not on every single one is a group assessment, I don’t think that’s giving the student weight enough experience, because not on every context and every situation in the workplace will there actually be teams and groups, and people have to learn to work on their own as well, so I don’t think it encourages independent learning.”

To the same question, Tom answered: “one of the problems with teamwork is that you are not able to determine who is doing the work on the project and who’s doing most of the effort.”

Penny, on the other hand, gave positive views on teamwork; however, there are not teamwork assignments in her taught courses. “Our programme is very industry based, so most of people when they graduate go into the industry so it’s really key that they know how to work effectively in a team, because that’s what they’ll be doing as students that step into any graduate career, so it’s really good for them to have the practice and improve their skills while
they’re here on the masters programme, especially as they have access to all sorts of students from all different nationalities, so it really is global.”

About the negative side of it, Penny mentions occasional student complains about colleagues with weaker performance, however mentions “they feel frustrated having to do all the work for the others or they may jeopardize their own grade if they don’t do somebody else’s work if somebody is not performing; so that can be difficult to manage, but again is great experience to go forward in your career and have to manage people with different motivation levels and so on”.

An interesting approach taken by Penny to avoid weaker students affect their colleagues is: “we would normally allocate the groups based on their performance on semester one, so it would not be so random and we’d normally group the top performance together and then the bottom performance together so then it’s not so likely that the bottom performance will be coasting on the efforts of the top performance because they’ll have to make their own way, sometimes that just works better because then, sometimes they feel a little bit, perhaps in all, if they’re with somebody that’s high performing because they tend to take over, but then when they’re left on their own decide devices the bottom performers tend to do step up to the mark and get the job done in their own way.”

4.1.2 STUDENTS

Students on the other hand, showed more motivation and interest over teamwork. The main cited reason is the exchange of experiences from different cultures, especially given the internationality of the University in postgraduate programmes, which in the end they relate to their future work environment and the need to work in teams. Amy, a student from Germany pointed out three main points: 1) Getting to know different cultures, 2) Get to know how the people work and their personalities, and 3) Possibly achieve something together and present it as a group.

Lisa, student from the SML School, mentioned similar positive reasons to work in teams, however sees one downside: “it just took quite a lot of time from our written reports which sometimes was a bit too intense, but it’s good.”

Out of all the students interviewed, the majority mentioned they came across small problems while working in groups, but again, none of them talked about it as a reason to dislike teamwork assignments, on the contrary, they see it as part of the process and as an opportunity to learn from the experience.
Mathew, an SML student from France mentions the following: “Good experience, good experience, like always some problems, but it’s actually good experience […] there are different people from different countries and cultures, so teamwork is actually good because you discover so many different ways of working, so many different behaviours, good or bad, so, I quite like working in team with different cultures and different people.

4.2 COMMUNICATION ISSUES

There is no better way than a face-to-face dialogue, it could be in class or a meeting in the office if the person is having difficulties to find the colleague with whom they are having issues, however there seems to be a preference to discard completely online communications when issues start to arise.

Some lecturers will prefer not to get involved in these kinds of situations, according to Howard, when it comes to postgraduate students, he does not get problems like this “subcontracted” to him; this is something he will treat differently with undergraduate students, but believes postgraduate students should work these issues on their own. And indeed, interviews show that students would rather solve the problem within the group first and not involving the lecturer until the problem has reached an urgent stage.

When it comes to problems related to decisions affecting the work, students still recur to meetings, however it is recognised that this is not a problem with whichever tool they are using. Mathew mentions: “You will not solve a problem by email or Dropbox; they’re just tools when they’re working, when they’re not, it’s just face to face”

Arguably, the most important factor for people liking or not liking teamwork, is because of communication problems, for example, people coming late, not answering or even not showing up to meetings, which usually results in work not being done, or in some cases, someone doing another person’s work.

Other issues that may be present with certain tools, such as posts on an online group (Basecamp), is that people might assume that posting their ideas there, makes that idea “official”; for example, a person comes up with an idea for a change in the software his team is developing, posts it online and begins to work on it making changes on the project before everyone in the team has discussed the addition.

It is noted several times in the interviews that lack of communication has nothing to do with the tools, instead students point motivation as the main factor.
Students that mention other tools than the University Email, such as Facebook, mention their preference is a result of knowing their colleagues spend more time on that tool, and the likelihood of them reading a message is much higher. Facebook also has the ability to tell the sender if the message has been read (opened), a feature which as of today, cannot be disabled by the receiver.

An interesting idea to prevent some of the issues with “weaker” colleagues not working was mentioned by David, the idea is that in each meeting, the ideas and to-do’s were written on the whiteboard and each member would put their initials on their assigned task, after that a photo was taken of the whiteboard and uploaded to Basecamp.

None of the interviewed students mentioned the phone as a way to contacting their lecturers, in fact only one of them, Lisa, mentioned it as an option and stated she wouldn’t see it as an option and “would be too shy” to do it.

4.3 APPLICATIONS/TOOLS USED

The following is a thematic analysis of the data collected from interviews with students and lecturers regarding the applications and tools they currently use for collaboration. The applications that were mentioned have been ordered alphabetically in the following subsections in order to facilitate finding them; the order does not relate to any other criteria.

4.3.1 BASECAMP

Basecamp was only mentioned by David in the interviews as a tool used, it is noteworthy that this is the only interviewed student who has done all of his studies in the UK, and is in the Computer Science department.

Basecamp is described by the user as a tool for the phase of developing work: “with basecamp we had instant messaging or we posted ideas, we had also like whiteboard and such were people would give concepts, and people would just play with it.”

When asked if there was any feature he would add to Basecamp he mentioned: “No, I think basecamp did a really good job on how they’ve done it, I’ve used it a few times for a few projects in the last few years; like I said I like how it’s got whiteboard, messaging system, alerts when there’s new posts, the best thing is you can do work straight from your email, that’s what I always liked, you don’t even have to log into basecamp to send a reply; I don’t think there’s anything else, like I said I had a timetable, I think it’s really good.”
The fact he has used the application for a few projects in the last few years, and cannot describe any “missing” feature, suggests that it is a very complete application and, at least in the development phase of a team assignment, is a strong alternative.

4.3.2 DOODLE

Doodle was brought up during the research by two lecturers: Penny and Tom, as well as by one student: Jim, however, their use of it does not imply a considerable benefit in teamwork itself, rather, it is mentioned as an “easy, functional; it’s a much easier way to do that than any other way really”, when it comes to running online surveys.

Tom mentioned Doodle as an example of a feature that he would like to be implemented on Vision in order to help deciding the project assignation to MSc students.

Finally, the only student that mentioned this tool, Jim, did not reference it to an academic project, but instead to a role performed at the Student Association where he needed quick answers from their polls.

4.3.3 DROPBOX

During the research, Dropbox was usually compared to Google Docs by the interviewees, although essentially their functionality is not the same. Dropbox is used to store documents on the cloud and offers the possibility of sharing them with more people, whereas Google Docs, even though it stores documents on the cloud and has the possibility to share them, its main purpose is of creating and editing text documents, spread sheet and presentations within the user’s browser and, if shared, simultaneous editing of the document from different computers.

In any case however, the reviews from the people who mentioned it were positive, stating the ease of use and understanding, as well as the fact that “you don’t have to do too much” as described by Jim.

4.3.4 EMAIL

Email appears to be one of the most used tools for communication, as it was mentioned by all of the participants, however it is also the one that brought more critical comments when it comes to efficiency. Lecturers mention it is a good way of communicating with their students; however, it tends to be more time consuming, Howard mentioned: “ (It is) really just responding to student enquiries that they often have very specific questions and then it’s just really replying to them”, therefore it would seem preferable for direct communication with one student at the time.
Penny comments: “if I’m going communicate with the whole group I would normally use Vision, because then there’s record of it, so students can just login to Vision and see all the notices, for example if I want to refer to something I sent a couple of weeks ago and somebody asks me a question I say: “Oh, this was sent to you two weeks ago, have a look on vision under that date” so there’s a record of it”, referring to the Announcements tool on Vision.

All of the interviewed students mentioned it as one of the tools they use, but there was no real emphasis on its benefits and disadvantages as none of them mentioned it as their preferred tool. Other than it being “direct”, as mentioned by Amy, there was no other reference to it.

4.3.5 FACEBOOK

Facebook was another frequently mentioned tool used by students, as well as one of the lecturers, as a very efficient way of communicating with colleagues. Among the most commonly mentioned benefits is its ease of use and the fact that “everyone is on Facebook” and “everyone is quite often online and it’s just easier to exchange information and you can set a group and just collaborate in that way”, therefore facilitating communication.

Penny is also the deputy director of an MSc programme, she pointed out that within the programme; they have a Facebook group setup where students interact, the reason of having this Group is described as: “they tend to perhaps use their own personal emails or Facebook more than logging into the university account, so you got to get where the students are. […] On Facebook you can have a dialogue, a discussion going and then everybody else can see the dialogue, so usually if one person has got a question there’s guaranteed that there’s got to be more than one person who has got the same question as that, so that if somebody asks and you reply to them, then everyone can see it.”

Other positive characteristics of Facebook that were mentioned by Penny are that “it’s very easy to use and it’s visually appealing and everybody’s there; and you can share information more easily so if you’re following people you can then like, re-post it or put links in and so on. And it’s more up to date I guess, people have got it on them all the time generally, I’d say compared to Vision”.

On the other hand, when asked if they would use a tool like Facebook if it was available at the University, Lisa answered: “if there would be some kind of similar tool on our University it would not make sense because I don’t think people would be so much checking it”. In this case, the motivation of using these tools only for academic purposes might greatly affect the potential use and interest of students, which happens with tools like Email, where students check their personal accounts more often than their University accounts.
About features available on Facebook, it was mentioned twice that it would be useful to have a video conference feature within Facebook, one of the reasons being: “I wouldn’t have to open Skype and ask the people for their Skype name, because I have them all on Facebook so if they would have a number or like a Skype a Skype account within their Facebook account that would be just easier to access them.” This feature however was recently added to Facebook, in a more basic manner.

4.3.6 GOOGLE APPS

As it was discussed before, Google Apps consists of many different online tools offered by Google.

Interestingly, during the interviews, most of the participants were confused by the term “Google Apps” when asked if they have used it, often responding “no” or “I am not familiar with it”, however, when it was explained what Google Apps is, and disclosed by some of its apps like Gmail, Google Docs, Google Calendar, etc., the answer would become positive with all of the participants having used at least one of the applications, usually Gmail; this suggests that there is not enough information or knowledge available about the suite as a whole.

The most commonly used app is Gmail, which had positive comments from the interviewees due to its ease of use, neat interface and usability. Gmail is even used by some students to organise their University email, which can be fetched to Gmail via its POP3 feature, allowing users to completely override the need of logging to the University’s Webmail. Jim answered the following when asked which email account he uses, his personal or the university’s (specifically speaking about academic matters) “I use my personal email, because with Gmail you can have all the emails from the Heriot-Watt account so, I use both, but more often the Gmail account […] On the Gmail address you also have the chat, so you can use it, so it’s cool, it’s faster than email if you have all the people for chat, and I think you can create groups as well now, groups of projects so you can chat all together.”

Comparing it to the Email service currently available at Heriot-Watt, Amy said: “usually we used our own email addresses because I personally don’t like Outlook so this is why I am a bit more familiar with my own Gmail account. […] I can only compare it to the Outlook (Webmail) one, and it’s much… first it’s much quicker, second, the overview is better, it’s more organised, it’s easier for you eyes to see… I don’t know how or why, but it’s just easier to see where you replied already emails and you can have embedded folders and I’ve got the feeling it’s just more organised.”
Mathew commented the following about Google Apps: “I just love Gmail [...] I can just gather all my emails in one inbox and I can access it everywhere, I can link it with Dropbox, my agenda, I can share my agenda with different people. It’s just really convenient; it’s the most convenient tool for managing personal and professional.”

As for Google Calendars, it was mentioned by Tom, of which he outlines the following advantages: “we used the calendar for publicizing our seminars and the internal department activities, you can copy an HTML frame into the website that displays the actual Google Calendar, and this is quite useful, in fact we don’t only do it internally in Heriot-Watt with the Maths Department, but we hold joint seminars with the University of Edinburgh and we both update the same calendar, so it’s quite convenient for us.”

The third mentioned tool was Google Docs, which had as well positive comments from students, for example, Jim noted: “Google Docs was really good, [...] I liked that it was easy to understand how to use them. Those tools are really made to work in team, you can tell when you use it is really simple, you don’t have to do too much, you don’t have to understand too much, so it’s really easy to share information.”

The two students who mentioned Google Docs, also mentioned Dropbox has a better way of handling file versions and sharing, and said they would like to see a similar feature in Google Docs: “Something more like Dropbox that you actually have a file on your computer, you don’t need to open your browser, you don’t need to open Firefox, you can just have it on your computer, that would be an amazing thing to have on Gmail (Google Apps).” this feature however was recently implemented as part of Google Apps (known as Google Drive) in late April 2012, something the students were unaware of.

4.3.7 MENDELEY

This tool was mentioned only by one of the lecturers who participated in the research: Tom. He pointed out the advantage of this tool to easily share PDF documents among colleagues, as well as many options to export references in different formats for other applications to read. He however, notes the following: “For instance, the references, you can easily put reference in your document; you can produce a BibTex file for instance out of just clicking a few papers that you want to include in your list of references for a paper let’s say; you can share that with other colleagues; it’s quite flexible, [...] but very specific to research, I don’t see how could it be implemented in teaching.”
Office 365 was included as a specific question on the interview script due to the recent announcement at Heriot-Watt University that it will be implemented as a Cloud Service (for students only) in the near future. To the question “Have you used Office 365?” the answer in all cases was an outright “No”. The following are a few of the most descriptive answers towards this question:

- “No (laughs)... too bad.”
- “No, not even heard of it.”
- “Oh Microsoft... I'd rather use Google.”
- “What (is that)??”

Office 365 was however, related to another Microsoft application by two interviewees: Outlook, which indeed can work together with Office 365 by means of Calendar and Email. To this relationship, Lisa noted, “calendar can be really helpful“ and “can easily schedule group meetings, there’s a pop out on the screen 10 minutes before the meeting, which is quite useful.”

Skype as a tool was only mentioned by Amy as an alternative to emails in order to communicate with lecturers, the reason being: “I don’t know how often they check emails or how much (how many emails) they have to reply on, so, at the moment it’s not the best to communicate I think”. However, as it was previously mentioned, two students: Amy and Lisa stated that they would like to have a Skype-like feature on Facebook to make synchronous communication easier (See Facebook header in this section).

According to the interviews for this research, Vision has a mixed reception among both lecturers and students; these thoughts however, are clearly identified by their answers. On the positive side, interviewees are satisfied with the overall features offered by Vision, while the negative commentaries are mostly related to its interface and usability, as well as the lack of motivation from students to use it and participate on activities using its various tools.

Lecturers often prefer using Vision to post announcements to students, contrary to emails, one clear example was noted by Penny: “if I'm going communicate with the whole group I would normally use Vision, because then there’s record of it, so students can just login to Vision and
see all the notices, for example if I want to refer to something I sent a couple of weeks ago and somebody asks me a question I say “Oh, this was sent to you two weeks ago, have a look on vision under that date”, so there’s a record of it”. Penny pointed out a summary of the useful and most used features on Vision, however, ended the comment with an important negative side to it: “It’s a good space just to put everything there from the modules, so you can put your lecture slides up, you can have messages up, you could have tutorial groups I guess, links, videos, so it’s a good space to store lots of various types of information and data, I think that’s the best thing, and then people have access to it wherever they are, they can just log in whether at home, abroad, here on campus, so it’s a good repository I guess, for everything really… when it’s working.”; this suggests that, at least in this her experience, Vision can be often out of service, and this has build a bad reputation in her opinion.

Tom also pointed out the announcements tool to be quite useful used as a complement to email communication. He also mentioned the advantage of easily addressing everyone who is enrolled in the course, for which he mentioned: “it could be better, but it’s just difficult to design something that fits everybody. It works ok because it’s online, the front end is like the Outlook front-end for the email account so it’s very good, it’s integrated into the whole system”.

Vision also has a marking tool available for lecturers, which was mentioned by all the lecturers interviewed as one of their preferred features.

As for the negative views from lecturers, the most notable comment is about its interface, lecturers noted that “Vision is good, it’s effective but it’s not very interactive […] we don’t do things like discussion boards because we tend to find people don’t use them”, “I don’t think it’s very visually appealing, so I think it looks a little bit old fashioned for 2012”, “it can be really kind of fiddly, […] it can be much more user friendly.”

Howard pointed out: “Vision doesn’t encourage two way communication, that’s essentially about posting information and posting announcement, but then what that often does is that it will trigger emails, because students then contact you to say “What does this actually mean?” or “what is the submission date?” or “can I use this material?” which leads into spending a lot of time answering emails to students individually.

Finally, another important potential issue identified by Tom is that “sometimes the students shouldn’t be too dependent on that tool, if they start missing lectures because everything is in Vision, all the lecture notes are there, I mean, I don’t know how to do it, but if there is a way of encouraging the students to attend the lectures as well; because sometimes they don’t realise, but some of the lecture courses deliver something it’s not on the lecture notes, it’s
delivered by you telling the students something on the lecture and I mean they ought to take
notes or things like that, but sometimes they assume that everything is on Vision or the
exercises and all of the solutions are published there and this culture of us just tend to it. So,
trying to promote Vision or Blackboard by just putting everything, all the material available to
the students, that might not be beneficial for the students.”

Lecturers were also asked which extra features they would like to have in Vision, two answers
were notable, first, having a poll feature, similar to the one offered by the website
Doodle.com, which was discussed earlier in the document, the second approach was not that
of an extra feature, it was rather a recommendation to investigate the reason why students are
not motivated or don’t like the features already available, for what she mentions: “I think
there’s everything there; you’ve got the potential for a discussion board and things like that,
wikis, group spaces, but the problem is that people don’t really engage with it, so it’d be
interesting to find out why the students don’t like it. […] It would be interesting to see what
the students like, because obviously they’re not on Vision, not for discussions anyway, if you
set a group space, they don’t really engage with that, but then they will go on Facebook and
do their group space there.”

From a student perspective, the strengths and weaknesses mentioned relate to the same areas
mentioned by lecturers. Specifically, the interface and usability were mentioned as important
setbacks and a reason why students don’t engage with it.

• Jim: “It’s not so well presented, its access is not so good, for example when you log to
access to your courses, you can’t access your email, you need to log in again, so this
is… normally you don’t do that, you log once and you can have access to all, so I
don’t understand why you need to log in twice. […] The presentation is not good in
general, they need to change it”

• Mathew: “It’s good for interaction between teacher and students; between students,
there’s no way they’re going to use Vision, it’s not efficient enough, it’s slow, it’s not
good looking, there’s not enough tools, it’s just not ergonomic.”

These issues previously mentioned were the only ones mentioned by students, however, they
appear to be important issues, which notably lower the motivation towards using it.

On the other hand, students do recognise the value of the tools offered in Vision, especially
when it comes to gathering material for their courses. Mathew and David noted positive
aspects like: “You have access to all your material, this is good”, “you have all the information
you need, […] and you need a document or something the teacher put there; it’s quite good,
it’s good for interaction between teacher and students […] it’s a formal thing, just for things
between teachers and students I think it’s the best tool; it’s very useful, like, not a lot of universities have a pure Vision where teachers upload documents or puts some comments, it’s got really good tools, but as I said: between teachers and students.”

Related to the issues previously mentioned, it is also the fact that some lecturers avoid the use of Vision as well, this was described by David, who mentions: “I like what it’s trying, I just… I don’t know, I use it for gathering my sources, you know, my documents for classes that put them on there, but some of the lecturers don’t even use Vision anymore, they put them straight into their web links”.

The lack of motivation from lecturers inevitably results in lack of motivation from the students as well, this was suggested by a comment from Amy, who made the following comment: “We’ve never had really like group conversations, we only shared I think some statements or comments on a specific task, where we had to write a comment, and this was quite good because then you could just read what everyone has written, but to be honest I wasn’t really interested in it.”

### 4.3.11 OTHER TOOLS

A few of the participants briefly mentioned during the interview some other tools that they might have used during teamwork; however, these tools are specific to certain areas or activities. For example, Jim from the Computer Science department, mentioned SVN tools for collaborative programming such as Google Code and Assembla, however, not enough information was mentioned in order for them to be analysed separately.
CHAPTER 5: DISCUSSION

This chapter presents the findings of the research by comparing the data analysis to the literature reviewed on the topic. After this, a set of scenarios are presented as a recommendation to lecturers and students with the aim of helping them choose tools that could best aid collaboration and communication in different situations through the teamwork process; these scenarios have been made using the findings from the interviews as well as the literature review.

5.1 INTEREST IN TEAMWORK

5.1.1 LECTURERS

It could be argued that lack of motivation and resistance have a negative impact on the success of teamwork with lecturers that have predisposed ideas to collaboration. Therefore, if lecturers are resistant to teamwork and changes, it is likely that even with the use of the best tools available, teamwork will not give the results expected. According to Janas (1998), in spite of the big amount of educational reform efforts, the factor of resistance in lecturers plays an important role; the author also notes that there is a significant gap between the knowledge base available and what the general practice is in reality.

Resistance however can be used as an advantage, as long as it is identified and managed correctly; it can enhance innovation, growth and renewal, to achieve this, Janas (1998) suggests three steps: (1) Being aware of resistance, (2) Identifying sources and types of resistance, and (3) developing and applying proactive strategies for managing resistance.

It is not the aim of this research to understand the source of this resistance, however, the importance of it is noted and considered as a factor that could potentially affect collaboration within groups at the University.

For online collaboration tools to be effective, they require significant input and direction from the lecturers (Roberts et al., 2010) and students need the initiation from the lecturers in order to “climb their learning curves” (Tsai, 2010).

The type of resistance identified in the lecturers Howard and Tom is identified as “Aggressive Resistance”, as they clearly stated their negativity to engage their students with teamwork assignments after having tried it one time and having negative results.

The use of online collaboration tools can be used as an advantage in order to motivate lecturers to engage again in teamwork. According to the recommendations suggested by Janas
(1998), which were described previously in the Literature Review of this document: empowering stakeholders by introducing tools and mechanisms that provide them with authority and responsibility, and strengthening communication among stakeholders, are both actions that can help prevent or minimise resistance.

As it was mentioned previously, not all the lecturers interviewed see teamwork negatively; Penny noted the importance of the teamwork experience in her students as they will eventually go in the industry and perform in teams constantly, therefore, collaboration is not only good, but in a way “necessary for survival” (Wang, 2009)

The importance of gaining this experience highlighted by Penny fits both categories of social interaction: on-task and non-task suggested by Abedin et al. (2011), the first one related to group learning, while the latter relates to social activities within the group.

5.1.2 STUDENTS

Students that participated in this research provided enough evidence to suggest that usually there is an Affective Engagement on the part of students in relation to teamwork, as their reaction towards their peers and lecturers appears to be emotionally positive (Altinay and Paraskevas, 2007).

This positive perception of teamwork contribute to a high level of sociability, which is an important component for CSCL to be successful; this sociability will establish the extent to which collaboration tools will facilitate affective work relationships, cohesiveness in the group, trust, respect, satisfaction and a strong sense of community, which ultimately will leave to a better interaction between participants and collaborative activities, both key factors to a successful collaborative learning (Kreijns et al., 2007).

5.2 COMMUNICATION ISSUES

In order to avoid issues, or in order to solve issues happening, many of the participants preferred face-to-face meetings, making a transition from online to traditional communication; these face-to-face meetings are key to increase the frequency and frankness of exchange of information.

Group dynamics need to be supported by the lecturer when using online tools; these dynamics are often assumed to happen on their own as they might happen in face-to-face meetings, however isolation and lack of sociability in the teams are expected as challenges if lecturers fail to support group dynamics (Kreijns et al., 2007) (Abedin et al., 2011).
One of the concerns described by lecturers, as well as one student, was why students did not use the tools already available at the University, and if new tools were introduced, whether they would use them or not.

The current tools in Vision however, lack sociability, they do not offer students the feeling of integration, they do not fulfil all of the necessities they have. Students do not only seek for information when using these tools, they seek affiliation, support and affirmation; Online environments need to offer both educational and social functionalities in order to make a complete learning experience (Abedin et al., 2011).

Introducing new tools with state-of-the-art technologies does not necessarily mean students and lecturers will find them attractive and use them (Abedin et al., 2011).

The tools recommended for this research are not necessarily one complete Virtual Learning Environment; instead, different tools from different providers were included to complete the needs. Also, the intention with the use of these tools is to try to make social interaction the centre of the group learning process, a social interaction that is characterised by social relationships, social cohesiveness and a sense of community, the features of a social space.

The information the participants provided in the interviews, was taken into account in order to recommend a technologically, educationally and social functional.

5.3 APPLICATIONS/TOOLS USED

By combining the characteristics found on the literature review with the tools mentioned by the participants as well as other popular tools, a set of scenarios, which can be found in the Appendix 3 of this document, was created in order to serve as a guide to students and lecturers to find the adequate tool to use in certain situations. These situations were written to portray common issues faced in the different stages of teamwork assignments; in the case of lecturers, the scenarios describe situations in which they can get support from online collaboration tools in order to have a better communication and participation in their student’s work.

Each situation presented in the scenarios recommends a specific tool or application, however, it is important to note that the presented tool may not be the only one of its kind; the reasons why each tool was selected will be explained in the respective section where it is mentioned in this chapter.
The tools presented in the scenarios aim to create a learning and collaboration environment that meet criteria studied in previous research, as well as fitting the usability standards and also important, that have a good reputation among users.

In order to create a successful blended environment between online and traditional collaboration, there needs to be live events, the possibility of self-paced learning, collaboration, assessment and performance support materials with live synchronous events (Roberts *et al.*, 2010).

Additionally, online tools should follow the three stages of the cyclic framework proposed by Littlejohn *et al.* (2008): Conceptualisation, Construction and Integration of the resources.

To allow an easier reading and understanding of the use of these tools, they will be presented in the following way: Each section represents a tool, and will contain a snippet of the scenario or scenarios where it was used in order to explain specifically the feature used.

### 5.3.1 SYNCHRONOUS AND ASYNCHRONOUS TOOLS

Synchronous and asynchronous tools offer different advantages and disadvantages to users, however, it is a combination of both of them that will lead to an effective collaborative learning environment that would offer an adequate communication support (Wang, 2009) (Altinay and Paraskevas, 2007). This suggestion was confirmed by the data gathered from the interviews in the way of describing the tools used depending on the activity or stage of the teamwork process for which they needed to use certain tool.

According to Altinay and Paraskevas (2007), there are tools that could lie in between both categories, some of them depending on how they are used. The research confirmed the use of some of these tools is becoming more popular as new technologies are implemented. For instance, Google Talk and Facebook have an Instant Messaging feature (synchronous), however, if the recipient of the message is not online, the message will be sent as a regular message (asynchronous). Both of these tools were mentioned by more than one participant and it can be suggested that recent technology is allowing these “hybrid” tools to be developed; Google Docs is a clear example of modern tools that combine both characteristics: users can work on a document in real-time, but this is not necessary for the tool to work. If only one user works on a document at a certain point, others will see the changes reflected when they access. Additionally, Google Docs features a version tracker to facilitate this.
5.3.1.1 DOODLE

An asynchronous tool that helps students and lecturers schedule events, it can be used to enhance and facilitate how lecturers program the hours they are available for consultations. In this example, Penny, will offer students “online office hours” as part of her online course, and in order to decide which hours, she has posted on Doodle her available hours, from those, students will “vote” for three timeframes where office hours will be held. In the end, the lecturer can easily export the chosen hours to her personal calendar application.

The contribution of this tool can be categorised as that of “coordinating collaboration”, which is key for groups that go through a process of learning because in order to complete a task more efficiently, coordination should be supported (Wang, 2009).

Additionally, Penny has set up three hours during the week where she will be available for IM or video call in both Google Talk and Skype. During this time, students can contact her to ask her any questions regarding the course. This is the equivalent of a lecturer having available office hours for students to drop by the their office, but in this case, for online students that may not be in Edinburgh.

In order to decide the “online office hours”, she has proposed a few options and the students will vote on their preferred times using the website Doodle.

Figure 4: Snippet from “Online Course for Lecturers” scenario.

5.3.1.2 FACEBOOK

Facebook was used in the scenarios as a secondary tool to post low-priority messages to colleagues in order to arrange meetings or discuss other low-priority tasks.

Most of the tools suggested in the scenarios belong to Google’s ecosystem, and it is generally easier for users to stay within this ecosystem, however, in this case, Facebook was chosen over Google+ because of the popularity of Facebook, contrary to Google’s social network, which is not well known, the majority of students use and check their Facebook accounts constantly.

Additionally, Facebook has the ability to send private messages easily and with read receipts sent.
5.3.1.3 GOOGLE APPS

Google Apps have been strongly suggested in the scenarios for various reasons, some of which are their wide availability in any computer with Internet access, as well as in many portable devices like smartphones and tablets, ease of use, high usability, single sign on (user logs in one page and does not have to log in again if another App is accessed), popularity (many students and lecturers already have an account and use it), familiarity, reliability, among others.

Other solutions like Office 365 offer similar features, however, they lack some important features, for example: it offers Word Web App, an equivalent of Google Docs. However, this tool at the moment does not offer automatic refreshing of the document, which affects greatly the real-time collaboration experience. Google Docs on the other hand, reflects changes made by other users in real-time and without any intrusion, this feature even works when accessing via a smartphone or tablet.

Several Google Apps are recommended throughout the scenarios, however, two of the most relevant and innovative are Google Docs, which has been explained before, and Hangouts.

Hangouts was chosen due to its potential and it is arguably one of the best alternatives to face-to-face meetings, offering video-conference with up to ten participants at the same time, allowing them to also share in the view space web pages, videos, documents and the user’s computer screen. This tool is new to Google Apps and is not well known and not as popular as Skype, however it was chosen over it because it offers support to 10 participants for free, whilst Skype offers only one-to-one calls for free, and group calling only to paying customers.

Two examples of its use in the scenarios are presented below, one for students and another for lecturers.
During the first week of the semester, Penny will offer the students video conference calls to introduce them to the collaboration tools that will be used, such as Google Groups, Hangouts and Vision for those students who are unfamiliar with them; these will be scheduled with the help of Doodle as well as they have a limit of 10 participants (9 plus the lecturer).

FIGURE 6: SNIPPET FROM “ONLINE COURSE FOR LECTURERS” SCENARIO.

After those steps were completed, the team set up another Hangout meeting and using Google Docs, they created the final report together, each making sure their parts were in the right place and complete. Once the report had been put together, everyone proof-read the document after the meeting, to allow them to better concentrate and focus on the task; using Google Docs commenting tool, the team put together the relevant comments and in a new Hangout, worked on those comments in the videoconference.

FIGURE 7: SNIPPET FROM “ONLINE COURSE FOR STUDENTS” SCENARIO.

Another tool suggested in the scenarios is Google Drive, used to share files easily with colleagues. As well as Hangouts, this tool is new in the Google ecosystem, and it was included instead of Dropbox, a more popular tool of this kind, because of the same reasons as Hangouts, its interoperability with other Google Apps, particularly Google Docs.

Once the team has finished working out their projects individually, they need to put together everything in one programme that “makes sense”, this was done during the meetings, the way of working consisted in the following:

Each member of the team first briefly presented their part, explaining why it is relevant to the assignment and the implementation plan, after which the team put their comments on a document in Google Docs, after each member, the team will discuss the project and make relevant suggestions. Once every member has presented their project, they will each work on the comments made.

FIGURE 8: SNIPPET FROM “TRADITIONAL COURSE FOR STUDENTS” SCENARIO.

5.3.1.4 VISION

Vision continues to be the main platform for all of the online collaboration at Heriot-Watt, and while most of the participants had several complaints about its design and usability, they
also complimented its usefulness when it comes to delivering its main objectives, such as being a repository for course material.

Regarding this research, and particularly the recommendations reflected on the scenarios, Vision was mentioned as an adequate tool to post announcement to students, as well as continuing to be the repository for files and posting marks.

It is important to note that the University is currently in the process of upgrading Blackboard/Vision, and the update is scheduled to go live next academic year.

Additionally, during the development of this research, the University announced that the email provider will be changed to Microsoft Office 365; this will include access to Microsoft’s Office Web Applications, a direct competitor of Google Docs. However, these tools were not considered for the scenarios as Microsoft is currently undertaking a complete upgrade of their services, having already upgraded the Web Mail, and with plans to upgrade the rest in the following months. The current versions of the Web Apps have some limitations that are discussed in the corresponding section of this document.
CHAPTER 6: CONCLUSIONS

This chapter presents the final conclusions to the research, these conclusions are organised according to the specific objectives of the research mentioned on the introduction of this document. Additionally, limitations and future research recommendations are discussed to conclude this investigation.

The main objectives of this investigation, which were presented in the Introduction and in the Research Methodology chapters, were successfully achieved as it was intended. And while some limitations were found (see corresponding section later in this chapter), they did not affect the work significantly. The objectives are reviewed and discussed in the following paragraphs.

• To identify strengths and weaknesses of cloud-based communication solutions available for Educational Institutions.
• To investigate if cloud based tools currently available in the market can improve participation of students in Online Based Collaborative Systems
• To identify the communications tools already available for Heriot-Watt students and lecturers and compare them to the solutions found.
• To determine if cloud based tools can motivate students to use them.
• To propose a series of scenarios for students and lecturers to consult in order to find appropriate tools.

As it was discussed in the methodology section, the interviews aimed to understand the tools that are regularly used by students and lecturers, and by comparing them with the literature to understand participation and characteristics of successful collaboration tools, the research was able to conclude with the scenarios proposed in the last objective by using the tools that were found to be a better fit to both these characteristics, by finding and comparing their strengths and weaknesses, which are mentioned in the corresponding sections (Literature Review and Discussion), and by taking into account the ones participants preferred.

Additionally, the interviews helped to understand why the students prefer other tools instead of those offered in Vision, identifying the main issues as obsolete and non-friendly interface and lack of sociability.

Moreover, students interviewed appeared to be more attracted and motivated to use freely available tools over those available in Vision as it does not offer the necessary tools for collaboration, particularly in a synchronous manner.
6.1 CURRENT TOOLS AVAILABLE AT HERIOT-WATT

The literature review suggested that for collaboration online tools to be successful, a strong sense of sociability is necessary, and even when the tools are technologically advanced and popular, the risk of not being successful among students is greatly related to its sociability capabilities.

The participants of this research confirmed this suggestion with their views on the current VLE available at Heriot-Watt and its tools. As research confirmed, students, and sometimes, even lecturers, prefer to use other tools available for some tasks.

One particular example of this was the email, a few students pointed out that they forward their University inbox to a personal email in order to avoid using Vision’s interface. Users commented Vision’s lack of usability and interoperability with other tools within the same ecosystem. Moreover, the tools available are asynchronous; there is no balance and opportunity for users to collaborate in real-time.

Other tools reviewed, like Google Apps, offer users a much easier environment that could motivate more participation from them. These features include a well-established and secure ecosystem, and it’s balanced with synchronous and asynchronous tools. However, it is also important for lecturers to engage and motivate students to use these tools, in other words, act as a facilitator; failure to do so, will result in students not engaging themselves to the available tools.

Another important current disadvantage of Vision is its out-dated version of the Blackboard platform in which it is built from, which has not been updated in recent years. There is however an on-going project for this update, which is scheduled to be released in the near future (see Limitations section).

6.2 COMMUNICATION

Arguably, one of the biggest fears and issues with online communication tools, is the lack of communication, because of these, literature suggest a mixture of both asynchronous and synchronous tools to complement each other, as well as having tools that simulate as best as possible, real face-to-face meetings, such as video calls.

It was noted during the research that participants tend to jump from online tools to face-to-face when they encounter issues in communication online; the reason for this is not clear, and could led to new research on this behaviour. However, it is understandable in groups where weaker students don’t perform to expectation, that “stronger” members would attempt to fix
the issue in the fastest way possible as their own marks are at stake; a suggestion made by one of the lecturers interviewed.

Research also suggests that in order to reduce the risk of issues among team members that collaborate online is to enable face-to-face contact before starting the actual work. The study suggests that this will enable more open, free and honest contributions, as well as frequency of collaboration among peers (Roberts et al., 2010).

6.3 HERIOT-WATT STRATEGY

Heriot-Watt University is aiming in its strategy to improve its Virtual Learning Environment in order to offer students tools that offer interaction, collaboration and a structured environment; as well as introducing up-to-date technology in it that will create new ways of learning that will enhance the experience of the students (Heriot-Watt, 2008), and it has been confirmed by this research that much improvement is needed in the current tools available.

This needed improvement is well known by the University, and they have already enough data to confirm it, as well as suggestions by their own staff and students collected in surveys conducted by the Academic Enhancement Department.

The new Blackboard upgrade and integration of Microsoft Office 365 suggest there is indeed an intended improvement over current technologies, however, it is difficult to foresee their success, particularly that of Office 365 as it is currently not a popular tool with students. Moreover, Microsoft undergoing a major upgrade of their services, to which there is no public access yet (see Limitations).

6.4 SCENARIOS

Finally, this research concludes with a series of scenarios aimed to students and lecturers in order to serve as a guide to find and understand the possible uses of different tools available online in order to incorporate them in favour of their studies, particularly, enhancing their teamwork experience.

Four scenarios were created, two for students and two for lecturers, of those two sets, one scenario targets online courses and the other scenario targets traditional courses. As it was previously mentioned in the document, the scenarios suggest specific tools to be used; however there may be other tools available online, which offer the same or similar capabilities.
The tools included were selected because of their popularity among participants of this research and the perceived popularity, as well as because they feature characteristics that according to the literature, belong to effective learning resources.

According to the characteristics discussed in the literature, the tools suggested in the scenarios compile to the majority of the features that characterize a successful tool. The most important of these features are the following:

- Promote sociability and facilitates communication among users via its interoperability of services
- Provide both synchronous and asynchronous tools, therefore obtaining the advantages of both and complementing their disadvantages.
- Enable lecturers to attach to the five key ingredients for a successful blended learning approach suggested by Roberts et al. (2010) by providing the necessary tools for live and synchronous events, collaboration and self-paced work and assessment (commenting tools)
- Have majority of the twelve characteristics of effective resources presented by Littlejohn et al. (2008) as materials can be easily sourced in repositories with Vision and Google Drive, most of the tools are updated regularly with feedback provided by millions of users, which also provides quality assurance, they are free and they are accessible in multiple formats for different devices, to name a few.
- Motivate participation by offering tools already available to public domain and to which most people are familiar with.
- Enable both on-task and non-task activities of social interaction in collaborative learning discussed by Abedin et al. (2011).
- Enable constructivist learning by offering discussion tools for students to use as well as enabling the lecturer to monitor the discussions effectively.

The final set of scenarios is included on the appendix of this document, the reason to do so is because they are aimed to students and lecturers in general, and as so, they are written in an informal manner. Additionally, as a final result of the research, it will be easier for students and lecturers interested in these results to access them in order to apply these suggestions in their work.

The proposal of this project is justified by a need identified from Heriot-Watt students and lecturers in a survey conducted by the Academic Enhancement department of the University (Kipar, 2011b, Kipar, 2011a), where both students and staff pointed out improvements
wanted to the current VLE (Vision) all of which are offered by Google Apps. A summary of the answers provided by the participant is presented below:

- Mobile phone version or apps.
- Increased interaction and collaboration.
- Standardized use.
- Improved ease of navigation.
- Improved layout and design.
- Customizable layout.
- Server for video streaming of lectures.
- Synchronous chat.
- Improved group management.
- Improved user management.
- Improved usability.

6.5 LIMITATIONS

During the development of this research, three main limitations were encountered, however, their impact was not severe on the results of the investigation.

The first limitation was the limited number of potential participants. Since the investigation was carried out during the summer, many postgraduate students and lecturers are not present at the University on a daily basis. Many foreign students tend to leave the UK for the summer and many lecturers have their annual leave. This limitation also reduced the number of possibly getting a wider selection of tools suggested by different students, and in order to expand these in the future a recommendation is also made in the next section.

Secondly, as it was pointed out earlier in the document, both Vision/Blackboard and Microsoft Office 365, are undergoing major upgrades, however these tools were not available for this study, therefore only current public versions were used.

Finally, it was originally intended to carry out an interview with a staff member of the IT Services department at Heriot-Watt University in charge of the upcoming Office 365 project in order to understand the project objectives, reasons for choosing this suite over other solutions and in general, more information about this implementation. Unfortunately, due to the busy period that summer represents for the department, it was not possible to schedule the interview face-to-face. As an alternative the questions were sent via email, however, no further answer was received.
6.6 RECOMMENDATIONS FOR FUTURE RESEARCH

Different approaches to online collaboration tools can be taken in order to better understand their use and success. For this research, a qualitative methodology was used in order to better understand the views of the users, however, a quantitative approach could be also useful in order to get a better and wider insight in the tools used by a bigger sample of students, by focusing on which tools are used instead of how they are used.

Another interesting approach would be to investigate the behaviour of students towards the tools offered at the University. This was pointed out by one of the lecturers, when she suggested that even if popular tools like Facebook were implemented at the University, students might not use it. An investigation to understand this would further complement the findings of this research.

Finally, as it was mentioned before, the upgraded versions of Blackboard and Office 365 which will be implemented at the University in the near future, were not included in this research due to their unavailability to the users, and while it was possible for the researcher to gain access to an early version of the new Blackboard, it would not have been possible to understand the views of the students. Therefore, it could be suggested as well to upgrade the results of this research to include these two tools once they have been implemented and both students and lecturers have been familiarised with them, and finally, including them in the scenarios should the research indicate their inclusion promotes collaboration and communication accordingly to the literature.
REFERENCES


APPENDIX 1: INTERVIEW SCRIPTS

1.1 INTERVIEW WITH LECTURERS

Hello and welcome,

My name is Daniel Almaguer, we have previously spoken to arrange this interview and as I have informed you, I am doing this research to support my dissertation project.

The purpose of this interview is to identify and gather data and opinions on cloud-based communication tools that could help students improve their collaboration activities at the university and contrast them with currently available tools at the University.

This is going to be an open discussion, so please bare in mind that I am looking for your views and opinion on the topics we will discuss, therefore there is no right or wrong opinion, so feel free to say exactly what you feel about any given topic, as I would like to hear all of your agreements and disagreements on them.

As I also mentioned on the invitation, this interview will be recorded with two purposes, the first one, for me to avoid taking too many notes as we speak and have a better talk, and secondly, in order to better analyse the valuable information you will provide me with at a later time; but be sure this recording will not be reproduced or replayed by or to anyone else but me and in rare cases, my supervisor.

Before we proceed with our chat, I would like you to read this consent form where you can see your rights as a participant of this research.

Do you have any questions about this?

Let’s start

First of all, I would like to confirm some of your information.

1. Name
2. Department
3. This interview requires for you to teach a course where you requested a team coursework, in how many courses did you request team coursework this academic year?
4. How was your experience with them? (Positive and negatively)
5. Is there anything about teamwork you find interesting?
6. What tools did you use to communicate with your students?
7. Do you prefer any of those in particular?
8. Describe your experience using this tool
9. Is there anything about it you find interesting?
10. What do you do if you have problems communicating with your student using technology?
11. Is there any other feature you would like to use in this tool(s)?
12. If it were available right now, would you use it? Why?
13. Do you provide or promote any collaboration tools to your students?
14. Do you prefer any of those in particular?
15. Describe your experience using this tool
16. Is there anything about it you find interesting?
17. What do you do if your students report any problem with the tool being used?
18. Have you ever used any other cloud-based communication tools available on the Internet to teach or communicate with your students? (Give examples in case they are unfamiliar with any particular one, e.g. IM chat, email, groups, hangouts, social networks, etc.)
19. What is your expertise with that tool?
20. What do you find interesting about it?
21. Describe your experience using this tool
22. Is there anything about it you find interesting?
23. If it were available for you at the University now, would you use it? Why?
24. Have you used Vision/Blackboard collaboration tools for teamwork?
25. Is there anything you like in Vision/Blackboard collaboration tools for teamwork?
26. Have you used Google Apps for teamwork?
27. Is there anything you like in Google Apps for teamwork?
28. Have you used Office 365 for teamwork?
29. Is there anything you like in Office 365 for teamwork?
30. Have you used other solutions for teamwork?
31. Is there anything you like in those other solutions for teamwork?
1.2 INTERVIEW WITH STUDENTS

Hello and welcome,

My name is Daniel Almaguer, we have previously spoken to arrange this interview and as I have informed you, I am doing this research to support my dissertation project.

The purpose of this interview is to identify and gather data and opinions on cloud-based communication tools that could help students improve their collaboration activities at the university and contrast them with currently available tools at the University.

This is going to be an open discussion, so please bare in mind that I am looking for your views and opinion on the topics we will discuss, therefore there is no right or wrong opinion, so feel free to say exactly what you feel about any given topic, as I would like to hear all of your agreements and disagreements on them.

As I also mentioned on the invitation, this interview will be recorded with two purposes, the first one, for me to avoid taking too many notes as we speak and have a better talk, and secondly, in order to better analyse the valuable information you will provide me with at a later time; but be sure this recording will not be reproduced or replayed by or to anyone else but me and in rare cases, my supervisor.

Before we proceed with our chat, I would like you to read this consent form where you can see your rights as a participant of this research.

Do you have any questions about this?

Let’s start

First of all, I would like to confirm some of your information.

1. Name
2. Age
3. Course
4. This interview requires for you to have taken a course this year where you did a team coursework, how many did you participate in?
5. How was your experience with them? (Positive and negatively)
6. Is there anything about teamwork you find interesting?
7. What tools did you use to communicate with your colleagues?
8. Do you prefer any of those in particular?
9. Describe your experience using this tool
10. Is there anything about it you find interesting?
11. Is there any other feature you would like to use in this tool(s)?
12. If it were available right now, would you use it? Why?
13. When it comes to actually working on the assignment with your colleagues, which tools do you use?
14. How do you put together everyone’s work?
15. Is there any tool you prefer to do this? Why?
16. After the work is put together, how do you usually review it?
17. Do you use any tools for this? Explain
18. What do you do if you have problems communicating with your colleagues using technology?
19. What tools did you use to communicate with your professor?
20. Do you prefer any of those in particular?
21. Describe your experience using this tool
22. Is there anything about it you find interesting?
23. Is there any other feature you would like to use in this tool(s)?
24. If it were available right now, would you use it? Why?
25. What do you do if you have problems communicating with your professor?
26. Have you ever used any other cloud-based communication tools available on the Internet for a university team coursework? (Give examples in case they are unfamiliar with any particular one, e.g. IM chat, email, groups, hangouts, social networks, etc.)
27. What is your expertise with that tool?
28. What do you find interesting about it?
29. Describe your experience using this tool
30. Is there anything about it you find interesting?
31. If it were available for you at the University now, would you use it? Why?
32. Have you used Vision/Blackboard collaboration tools for teamwork?
33. Is there anything you like in Vision/Blackboard collaboration tools for teamwork?
34. Have you used Google Apps for teamwork?
35. Is there anything you like in Google Apps for teamwork?
36. Have you used Office 365 for teamwork?
37. Is there anything you like in Office 365 for teamwork?
38. Have you used other solutions for teamwork?
39. Is there anything you like in those other solutions for teamwork?
APPENDIX 2: CONSENT FORM

“Cloud-based Communication Tools at Heriot-Watt University”

Student: Daniel Almaguer – dha1@hw.ac.uk

I, _____________________, volunteer to participate in the research project conducted by Daniel Almaguer, student at Heriot-Watt University with the purpose of gathering information about Cloud-Based Communication Tools available at the University.

By signing this consent form I understand that:

• My participation in the project is voluntary and I can withdraw at anytime and without any penalties.
• My personal and contact information will be kept confidential and will not appear on any publication of the research.
• In case any quotation from this interview is needed in the publication of this research, it will not mention my name or any other information that may identify me.
• I agree and understand that this interview will be recorded and that the recorded material, as well as any other raw material, will not be made available to anyone apart from Daniel Almaguer and in rare cases, the project supervisor, Judy Robertson.
• In case the research needs it, I may be contacted again for a follow up interview or other participation, however, any follow up participation is voluntary and I may decline participating on it.
• I have been given a copy of this consent form.

Name: ________________________________________

Signature: ________________________________

Date: _________________________________
APPENDIX 3: SCENARIOS

3.1 ONLINE COURSE FOR STUDENTS

3.1.1 COURSE
Strategic Project Management

3.1.2 COURSE TYPE
Classroom Course

3.1.3 DESCRIPTION
This scenario consists of a teamwork assignment for a software engineering course where students take the course physically at the University.

3.1.4 COURSEWORK
For this scenario, four students: Lisa, Amy, Mathew and Jim are in the team; only Jim and Amy have already worked together before.

The assignment consists on creating a Programme Mandate for the University where they propose a set of projects that will contribute to the University’s strategy.

3.1.5 COLLABORATION TOOLS USED
Email, Google Docs, Google Hangouts, Facebook, Google Docs, Skype and Vision

3.1.6 PLANNING
For this phase, the team decides to meet after the lecture to talk about the assignment and distribute the work; they decide to do a face-to-face meeting to avoid any confusion or delay in answers that could result in delaying work.

All team members have a Gmail account; therefore, they can use both synchronous and asynchronous tools provided by Google to collaborate.
3.1.7 FACE-TO-FACE MEETINGS

They will have in the first weeks, one weekly face to face meeting, which will be every Monday at 11:00 at the Postgraduate Centre of the University, which is subject to be rescheduled if any member asks for it with at least one day in advance.

For each meeting, one member will be in charge of creating a minute using Google Docs, this way, everyone can comment and participate in real time; as the project progresses, they will discuss if more meetings are needed per week. During the rest of the week, the team has agreed to stay in communication to discuss any issues via asynchronous tools such as emails or posting private messages on Facebook, always including all team members in every post.
3.1.8 BRAINSTORMING

The assignment requires a lot of new ideas; therefore in the first meeting the team did a brainstorming session to establish the grounds of the assignment. For this, Google Docs was also used so that everyone could write using their own computer at the same time; this also helped the members with less confidence to talk during the discussion to participate equally.

3.1.9 WORKING AND MONITORING WORK

After the first brainstorm session, each member took two ideas to develop on their own time, after which they will upload the document created to a shared folder in Dropbox, where the team can review each other work and using Word change tracker and commenting tools, they will make suggestions on each document so that the original author of the document can work on that and have a draft ready for the next meeting.
3.1.10 FLEXIBILITY FOR STUDENTS USING ONLINE TOOLS

In the next meeting, everyone was present except for Amy, who due to personal commitments was unable to attend, however, since she discussed this a few days before the meeting with the rest of the team, they agreed to use **Skype** to include her in the meeting while she was at home. For this, they used Jim’s **iPad**, in order to be able to have his computer available to work.

![Image 3: Skype call on an iPad](image)

3.1.11 REAL-TIME COLLABORATION

The team pasted all the documents in one **Google Docs** document and reviewed the work together during the meeting, after all comments and suggestions were worked out, each team member was now in charge to research on his assigned project, which included researching costs, requirements, and everything else needed to implement it at the University.
COMMUNICATING WITH THE LECTURER

During this meeting, the team came about a few questions regarding the assignment that were not clear on the document the lecturer made available in Vision with the details of the requirements. For this, the team decided to re-edit an email as the meeting went through and send it once the meeting was over with all the questions that might arise.

The following week and while waiting for the lecturer’s answer, each member was responsible to finish a draft with all the requirements regarding his assigned project and have an implementation plan.

Before the next meeting, right after having the lecture, the team had not received an answer from the lecturer after a week; therefore, they decided to speak face-to-face with him in order to avoid any more delays.

INTENSIFYING WORK

Once their questions were answered, the team continued with their normal meeting, and since the deadline was approaching, they decided to start having meetings twice a week, where although they were face-to-face, they were actively using online collaboration tools such as Google Docs while in the meeting, and other asynchronous tools while off meetings in
order to keep communication on going. The team was using **emails**, Facebook and text messaging.

### 3.1.14 EVALUATION OF THE WORK

Once the team has finished working out their projects individually, they need to put together everything in one programme that “makes sense”, this was done during the meetings, and the way of working consisted in the following:

Each member of the team first briefly presented their part, explaining why its relevant to the assignment and the implementation plan, after which the team put their comments on a document in Google Docs, after each member, the team will discuss the project and make relevant suggestions. Once every member has presented their project, they will each work on the comments made.

**IMAGE 5: IMAGE OF GOOGLE DOCS WORKING ON AN IPHONE**

### 3.1.15 PRESENTING THE FINAL VERSION

Finally, the team will put all the projects in a single document in Google Docs, where everyone can review the final version. After this, Lisa volunteers to proofread the entire document and give a presentable format, while Mathew, Lisa and Jim work on the presentation, which they are to give in the last lecture of the semester.
The presentation is done using the Presentation feature in Google Docs as well, first as a draft, and in the end, Mathew volunteers to convert it and format it using Keynote in his computer.
3.2 TRADITIONAL COURSE FOR STUDENTS

3.2.1 COURSE

Software Engineering

3.2.2 COURSE TYPE

Online Course

3.2.3 DESCRIPTION

This scenario consists of a teamwork assignment for a software engineering course where students take the course online.

3.2.4 COURSEWORK

For this scenario, three students, John, Tom and David, who have never worked together before, are given the assignment to develop a small application that will simulate a competition of their choice, where the application will hold details of the chosen competition, i.e. competitor names, scores, average, level, etc. A manager will be able to add participants, set scores and get averages.

3.2.5 COLLABORATION TOOLS USED

Email, Google Docs, Google Hangouts, Facebook, Google Docs and Drive, Skype, SVN, Microsoft Word and Vision

3.2.6 PLANNING

Not all team members are physically in Edinburgh, therefore for this phase; the team decides to setup a Skype meeting after they exchange each other’s information via Vision.

3.2.6.1 MEETINGS

During this meeting, they establish that John has better experience in the design, Tom in coding and David in testing.

The team has divided the work according to their strengths and now plans to continue with online work.

By using their Google Accounts, the team can use both synchronous and asynchronous tools to collaborate.
They will have in the first weeks, one weekly meeting via Google Hangouts (videoconference), which they can access via their Gmail accounts; as the project progresses, they will discuss if more meetings are needed. During the rest of the week, the team has agreed to stay in communication to discuss any issues via asynchronous tools such as emails or posting messages on Facebook.

3.2.7 CODE REPOSITORY

Tom has more experience in coding professionally, therefore he is familiar with repositories, and he suggest using a repository in a website he is familiar with using subversion in the website Assembla.com, which can be easily configured in Eclipse, the Java IDE they will use to code.

3.2.8 WORKING AND MONITORING WORK

3.2.8.1 ISSUES WITHIN THE TEAM

During this stage, Tom was not online for the second weekly meeting; David and John decided to wait for a few minutes to see if he would show up, meanwhile trying to find him via Facebook, Skype and MSN, with no success.
After waiting for 30 minutes, David and John decided to do the meeting on their own and email John a minute of it, however they also agreed to set up new measures to prevent this. John sent an email to the team to know the reason of Tom missing the meeting, as well as to provide Tom with his and David’s mobile numbers, and ask Tom to send them his, as well as ensuring next time any member is unavailable to join a meeting, he will let the others know with enough time in order to reschedule.

### 3.2.8.2 SHARING FILES AND REAL-TIME COLLABORATION

The next week progressed as planned and no issues between members came across. As the assignment progressed, a few documents needed to be created, including diagrams, for this, the team was using **Google Drive**, a tool similar to **Dropbox** that allows file sharing, which also allows access to the documents via a web browser in order to do real-time collaboration.

For this next stage of the project, during the weekly meeting, the team divided the required UML diagrams in equal parts, as well as other documentation needed.

![Google Drive with Google Docs](image7.png)

**IMAGE 7: GOOGLE DRIVE INTEGRATED WITH GOOGLE DOCS**

### 3.2.8.3 WORK DISTRIBUTION ISSUES

During the following meeting, Tom did not have some of his documents ready, arguing that he did not know he was supposed to work on those. In order to avoid issues like this in the future, John suggested to create a Group in **Google Groups**, where they will post each meeting’s minute and before ending the meeting, each member will reply on the post acknowledging their work by writing each assigned task as a way of signing it; this way, the team can look back to it if any doubts arise.
3.2.9 INTENSIFYING WORK

The team also agreed to start meeting twice a week in order to review everyone’s work more often and avoid too much lost time in case an issue like the previously mentioned occurs again.

Using the Subversion tool in Eclipse was working for the team normally, however David did point out to his colleagues that each time an update was submitted, they needed to add a comment on the changes made in that update, as there were a few submissions that were uncommented and it became difficult to track the changes.

3.2.10 EVALUATION OF THE WORK

Once the team finished their coding, it was agreed on the meeting that every member should do two tasks: 1) Do the relevant testing on their part of code, and 2) Write the relevant documentation for the required written report.

After those steps were completed, the team set up another Hangout meeting and using Google Docs, they created the final report together, each making sure their parts were in the right place and complete. Once the report had been put together, everyone proof-read the document after the meeting, to allow them to better concentrate and focus on the task; using Google Docs commenting tool, the team put together the relevant comments and in a new Hangout, worked on those comments in the videoconference.
3.2.11 PRESENTING THE FINAL VERSION

Now that the document has been completed, John has volunteered to format the document using **Word**, as **Google Docs** does not offer sufficient formatting tools; The team agreed, but Tom suggested using the **Change Tracker feature on Word**, so that once the format was finished, the document will be uploaded to the shared folder in **Google Drive** and each change reviewed and approved by the rest of the team.
As for the code, each member had already finished testing of their part, however, the team decided to do another set of tests, this time, each member would test another member's code, in order to ensure they tested more scenarios. The team did the relevant testing on their own, and agreed to create a new document on Google Docs where they will track the changes; once this new testing phase finished, they will go through the document and work on the bugs found.

After the final document was proof-read by everyone in the team, and all comments in Google Docs were reviewed, the team was ready to submit the assignment along with the final version of the application, after reviewing as well each point posted on the bug tracker document.
3.3 ONLINE COURSE FOR LECTURERS

3.3.1 COURSE TYPE

Online Course of Software Engineering (for Lecturers)

3.3.2 DESCRIPTION

This scenario reflects a situation for a lecturer teaching an online course at the University.

3.3.3 COURSEWORK

Penny is the lecturer for this course, for which she has prepared one team assignment that will count as 50% of the mark of the course. Additionally, form the overall mark of the coursework, 90% will consist of the project and 10% of an individual report regarding the teamwork.

3.3.4 COMMUNICATION WITH THE STUDENTS

Before the course starts, Penny has set up a Google Groups account, and has invited the group to join via a Vision announcement.

With Google Groups, she is able to communicate with the whole class in one message, and if questions from students come, everyone can see them and even participate in the discussion, an advantage over emails.

The reason for choosing this method, is because before, he would post an announcement on Vision, which would trigger many questions from students via email, most of them would be related or be of interest for the rest of the class, and he would have to send a new announcement and respond individually to each student.

Additionally, Penny has set up three hours during the week where she will be available for IM or video call in both Google Talk and Skype. During this time, students can contact her to ask her any questions regarding the course. This is the equivalent of a lecturer having available office hours for students to drop by the their office, but in this case, for online students that may not be in Edinburgh.

In order to decide the “online office hours”, she has proposed a few options and the students will vote on their preferred times using the website Doodle.
Finally, Penny will also make available Podcasts of the lecturers via Vision for students that prefer this option to complement the reading material advised.

### 3.3.5 Introducing Communication Tools to Students

During the first week of the semester, Penny will offer the students video conference calls to introduce them to the collaboration tools that will be used, such as Google Groups, Hangouts and Vision for those who are unfamiliar with them; these will be scheduled with the help of Doodle as well as they have a limit of 10 participants (9 plus the lecturer).
Another tool to be used for coding is an SVN; she will leave the decision to the students on which tool to use, but she will post slides and a podcast on the basics of SVN.

Penny will continue to post other announcements on Vision that are not related to coursework, as well as Course Notes, Slides and Marks.

3.3.6 MANAGING ISSUES WITHIN TEAMS

During the semester, Penny received a complaint from one of the teams, claiming that one of the members was not working as expected. In order to solve these kind of issues, he decided to address the entire group during via an announcement on Vision and Google Groups; she required that from now on, each team should upload to the group in Google Groups a copy of the minute for each meeting, including if anyone was missing, as well as the log from the SVN they are using; this file is to be only shared with the lecturer and each team.

As another measure, each team will privately post to the group a screenshot of whichever tool the team is using to communicate, where it can be seen that each member acknowledges the task(s) assigned to him/her after each meeting.

3.3.7 MARKING THE COLLABORATION IN THE TEAMS

For the end of the coursework, each team is expected to deliver their Programme Mandate in a document, where they are to include a statement of the percentage of the work each member contributed to the assignment; if the percentage is not equally distributed, he will deduct the corresponding marks for the student or students with the difference; this after having addressed the team privately to discuss the reflected percentage in their document.

Penny also asked for the final log of the SVN tool in order to review each submission made from each student in the team.
3.4 TRADITIONAL CURSE FOR STUDENTS

3.4.1 COURSE TYPE
Classroom Course of Strategic Project Management

3.4.2 DESCRIPTION
This scenario consists of a teamwork assignment for a Strategic Project Management course where students take the course physically at the University.

3.4.3 COMMUNICATION WITH STUDENTS
Before the course starts, Howard has set up a Google Groups account, and has invited the group to join via a Vision announcement.

With Google Groups, he is able to communicate with the whole class in one message, and if questions from students come, everyone can see them and even participate in the discussion, an advantage over emails.

The reason for choosing this method, is because before, he would post an announcement on Vision, which would trigger many questions from students via email, most of them would be related or be of interest for the rest of the class, and he would have to send a new announcement and respond individually to each student.

3.4.4 INTRODUCING COMMUNICATION TOOLS TO STUDENTS
During the first lecture of the semester, Howard takes a few minutes to explain students about Google Groups and how to use it, as well as explaining that this will be the only way for communicating with him for enquiries about the coursework. He also encourages students to post any other relevant information they might find interesting and that could in any way help the rest of the class.

Additionally, he has required each time to sign a “contract” where all members of each team commit to work equally during the coursework, work any issues that might occur within the team and report if they find difficulties solving them.

Howard will continue to post other announcements on Vision that are not related to coursework, as well as Course Notes, Slides and Marks.
3.4.5 MANAGING ISSUES WITHIN TEAMS

During the semester, Howard received a complaint from one of the teams, claiming that one of the members was not working as expected. In order to solve these kind of issues, he decided to address the entire group during the lecture about it; he required that from now on, each team should upload to the group in **Google Groups** a copy of the minute for each meeting, including if anyone was missing; this file is to be only shared with the lecturer and each team.

As another measure, each team will privately post to the group a photo a whiteboard or piece of paper, where it can be seen that each member acknowledges the task(s) assigned to him/her after each meeting.

3.4.6 MARKING THE COLLABORATION IN THE TEAMS

For the end of the coursework, each team is expected to deliver their Programme Mandate in a document, where they are to include a statement of the percentage of the work each member contributed to the assignment; if the percentage is not equally distributed, he will deduct the corresponding marks for the student or students with the difference; this after having addressed the team privately to discuss the reflected percentage in their document.

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1 Image from http://www.google.com/mobile/mail/hero.jpg


3 Image from: https://drive.google.com/start#features


5 Image from http://www.proof-reading.com/images/step-1-editor_comments_pr_word_2010.png

6 Image from http://www.eduleadership.org/2011/02/02/stop-scheduling-via-email-try-doodle/

7 Image from http://www.google.com/+/learnmore/hangouts/