

2010

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### Recommended Citation

Cheong, Christopher; Tandon, Raghav; and Cheong, France, "The Effects of Project-based Learning Environments on Social Networking Site Usage: A Case Study" (2010). *ACIS 2010 Proceedings*. 101.  
<https://aisel.aisnet.org/acis2010/101>

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## The Effects of Project-based Learning Environments on Social Networking Site Usage: A Case Study

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### Abstract

*Traditionally, the social aspect of project-based learning was mainly in the form of face-to-face communication and supplemented by online media such as email and discussion boards. With the emergence of Web 2.0, social networking sites, which are renowned for their strong social element, appear to be another useful tool to further support the social aspects of project-based learning. An exploratory case study approach was used to investigate how participants involved in two different project-based learning environments used social networking sites. Preliminary findings show that learners in "intense" project-based learning environments tend to use social networking sites for quick access to resources whilst learners in less intense environments use them for both asynchronous learning and communication. All participants found the social networking sites to be easy-to-use and useful for sharing information. Social networking sites were found to be useful and convenient, but not essential for project-based learning environments.*

### Keywords

project-based learning, constructivism, constructionist, social networking site, Web 2.0

### INTRODUCTION

An important part of project-based learning is its social element. This social element is apparent in the collaboration of group members to complete the project. Traditional approaches to collaboration are usually in the form of face-to-face communication, however, there are also a number of tools available to allow online communication. Typically, these include emails and discussion forums. However, with the advent of Web 2.0 technologies, social networking sites appear to be a strong candidate to enable further online social communication and learning.

Social networking sites are sites in which users are represented by a profile and are able to create, maintain, and express a list of other users within the site with whom they have a relationship or connection with. These sites are renowned for their strong social element and are quite popular with the generation of people born after the 1980s.

Given their strong social focus, in this paper, we report on exploratory work in which we investigated how participants in two different types of project-based learning environments used social networking sites to support the social aspects of their projects. In particular, we examine how the differences in the two project-based learning environments led to different uses of the social networking site and its tools.

The contribution of the work is to determine how an "intense" project-based learning environment, i.e., one of a short duration (2 months) and one in which groups members see each other on a daily basis, affects how members use an SNS in contrast to a less intense project-based learning environment. A further contribution of

the work is to determine how the two project-based learning environments affected the usage of the SNS tools such as blogs, discussion boards, profile posts, and file sharing.

## **BACKGROUND**

Project-based learning is based on a number of educational theories that can be supported by Web 2.0 technologies, such as social networking sites. The social aspect of project-based learning is particularly important and social networking sites are conducive to this as they facilitate both synchronous and asynchronous online communication. A description of these theories and how social networking sites support them follows.

### **Project-based Learning**

Project-based learning (PBL) is founded on the underlying concept of “learning content by doing” (Dewey 1933). This idea, which originates from the work of philosopher John Dewey (Dewey 1933), has been further developed and used by many educators since. PBL has been discussed and defined in a variety of handbooks for teachers. Its concept revolves around projects with complex tasks based on challenging problems, which involve students to collaboratively undertake activities such as analysis, design, problem-solving, and decision-making. These give students an opportunity to work autonomously over the duration of the project and develop solutions in a real world environment, i.e., realistic and practical solutions (Jones et al. 1997; Thomas et al. 1999).

The theoretical foundations of PBL are based on ideas of constructivism and constructionism. Constructivism (Piaget 1969; Vygotsky 1978) is a learning philosophy in which knowledge is constructed by individuals through their interactions with their environment in their particular situations. Therefore, each individual's knowledge construction is customized and different.

Constructionism further develops the idea of individuals constructing knowledge incrementally. The theory of constructionism postulates that individuals learn best when they are constructing knowledge through the creation of an artefact that can be shared and reflected upon with others (Kafai and Resnick 1996; Papert and Harel 1991). For individuals to be engaged in learning, it is important that the artefact created is personally meaningful to them.

PBL also incorporates a degree of asynchronous learning, which is also based on the constructivist approach (Wu et al. 2008) and uses online methods to facilitate information and resource sharing outside the constraints of time and place among a network of learners and teachers (Mayadas 1997). This allows learners to work towards the project goals independently without regular face-to-face meetings, as well as allowing them to make progress towards goals in times that best suit them.

PBL is learner-centered, as the learner acts as the pilot for his or her learning experience with guidance from the teacher. However, although the learner is independent in his or her learning efforts, the project-based environment requires many levels of support to facilitate learners to engage in meaningful ways to produce quality work (Collins et al. 1989). The support element of project-based learning is a key element present in cooperative learning. Cooperative learning is defined by a set of methods which assist in collaboration and manage interactions in order to accomplish a specific goal or develop an end product (Panitz 1996). It covers a variety of methods of group-based learning approaches (Damon and Phelps 1989) and can be viewed as a set of instructional activities that encourage learners to collaborate in learning with each other and the teacher or instructor (Slavin 1987).

### **Web 2.0 and Social Network Sites**

Since its emergence in the late 1980s, the World Wide Web (WWW, the Internet, or simply the web) has gone through a significant metamorphosis. In its original incarnation, often referred to as “Web 1.0” nowadays, the web was a publishing medium in that a select few published information on the Internet and the masses accessed and read the information. However, today's emerging technologies have promoted access and usability with the materialization of new media forms. The web has undergone (and is still undergoing) a transformation from a static medium to a highly dynamic medium in recent years. The term “Web 2.0” is used to describe this new version of the web.

Web 2.0 is used to describe web-based applications that encapsulate a set of competencies and principals that distinguish themselves from previous generations of software. Web 2.0 relies on user participation and it is a collection of web-based services that allow users to collaborate, contribute and share information through an online medium. The development of Web 2.0 has shifted the focus of the Internet from a medium in which information is transmitted and consumed by users, into a collaboration medium that allows content to be created, shared, edited and repurposed, and ultimately passed along so other users can do the same (Downes 2005).

There are a range of Internet technologies that collectively fall under the Web 2.0 umbrella; these include blogs and wikis (Boyd and Ellison 2007) as well as social networking sites (SNS).

Social networking sites (SNSs) allow individuals to present themselves, articulate their social networks, and establish or maintain connections with others. There are a variety of SNSs; examples of popular open SNSs include: Facebook<sup>1</sup>, LinkedIn<sup>2</sup>, and MySpace<sup>3</sup>, while examples of closed SNSs are Ning<sup>4</sup> and Elgg<sup>5</sup>. Open SNSs are those that are open to the general public whilst closed SNSs are those that are restricted to a private subset (e.g. employees of a particular organization).

There is no consensus on the exact definition of an SNS, however, they are generally viewed as sites with web-based services that allow their users to (Boyd and Ellison 2007): (1) create profiles within the system, (2) articulate a list of other users with whom they share a connection of relationship with, and (3) view and traverse their list of connections or relationships and those made by other users in the system. SNSs often contain other Web 2.0 technologies, services, or tools within themselves. Common services or tools present in SNSs include, profiles, blogs, discussion boards, social bookmarks and micro-blogging.

SNSs are often embraced by individuals from the variously named Generation Y, Digital Natives (Prensky 2001) or the net generation (Oblinger and Oblinger 2005). These individuals are from a generation born approximately after 1980, have had digital technologies present from their birth, and hence have grown up “natively” with digital technology. The widespread adoption of SNSs by this group of individuals, indicate the potential use of SNSs as education delivery tools since the technology and sites are intuitive to them.

The presence of Web 2.0 allows a variation to the traditional classroom-based framework as it allows access to information at any given time, thus providing learners an asynchronous approach to learning (Thompson 2007). Educational social software (Anderson 2005) has emerged to exploit this opportunity. Education social software is defined as network-based tools to support and encourage collaborative work between learners that also allows them to control their own time, space, presence, activity, identity, and relationship (Anderson 2005). This is evident in the tools available within SNSs; for example discussion boards and blogs promote learning at an asynchronous level. Learners are able to access content, collaborate, and learn at any given time, rather than be constrained to classroom activities and times.

The constructivist approach (refer to “*Project-based Learning*”) emphasizes a change of control on the learning process as control shifts from teacher to student. Using a constructivist approach learners now play an active role in the learning process. There is a shift of learning activities as the learning takes place with the collaboration and inputs from learners, rather than direct instructions from teachers. In contrast, teachers focus mainly on administrative and preparative activities (Ullrich et al. 2008). E-Learning can be used to support the constructivist approach as it enables learners to engage in interactive, original, and joint activities during knowledge construction with each individual building upon others’ knowledge (Zhang et al. 2006). SNS tools such as wikis, and discussion boards allow learners to participate in collaboratively building resources (Parker and Chao 2007), as users build upon wikis and discussion boards there is a construction of knowledge.

Elements of the constructionism (refer to “*Project-based Learning*”) approach are particularly evident in SNS tools such as wikis. Wikis themselves are in line with the approach as they are self-constructed, meaningful “objects-to-think-with” (Papert 2000). Learners are able to follow instructional wiki pages and construct an artefact, with which once complete, they can reflect upon, by updating the wiki pages or leaving comments.

### SNS Implementation

There are various different implementations of SNSs. SNSs such as Facebook, LinkedIn, and MySpace are free and open to the general public. These sites are already hosted on a server and membership to these only requires user registration. Other SNSs, such as Ning, allow users to create their own closed SNSs online. Ning allows individuals to create their own social network for a particular topic or need, catering to specific membership base. The site is already hosted on the necessary hardware and users simply need to register to become members.

Elgg is a closed social networking platform and is not hosted online. It is an open source platform that must be downloaded, installed, and configured on a web server. This allows for the creation of a closed SNS that can be

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<sup>1</sup> <http://www.facebook.com>

<sup>2</sup> <http://www.linkedin.com>

<sup>3</sup> <http://www.myspace.com>

<sup>4</sup> <http://www.ning.com/>

<sup>5</sup> <http://www.elgg.org>

used for either public or private purposes. That is, it is possible to have a number of different Elgg-based sites. For example, an organization can use Elgg as an internal site for its employees or as an external site to communicate and network with its customers and partners.

## **PROJECT-BASED LEARNING ENVIRONMENTS**

The two project-based learning environments that were investigated both involved the use of SNSs to support their social aspect online. These environments are from the same information systems school and involved undergraduate students an information systems program that contains a mixture of business and information technology courses. A description of these environments follows.

### **Capstone course**

The capstone project course (referred to as “capstone course” henceforth for brevity) is a final year and final semester course in which students are organized into groups of approximately six members and are required to complete a real-world, non-mission critical, and industry-based project. The students are expected to consolidate their knowledge and skills acquired during their program to complete the project and, thus, the capstone course can be seen as a final test of readiness.

Each group is assigned an academic supervisor, who guides them through the process, and the group is required to meet its supervisor once a week to report work progress, discuss any issues, and plan for future work. The course is structured around the software development lifecycle and obviously involves group-based learning. By using a meta-cognitive supervisory approach, it has been shown that it is possible to enhance group-based learning to cooperative learning in this particular learning environment (Cheong 2010).

In the capstone course, groups have the liberty to determine how to manage their project and the freedom to choose appropriate tools and methods. In 2009, one particular group of capstone students elected to use Facebook as the primary electronic medium for communication for their project.

The initial decision to use Facebook revolved around the fact that most of the team members already had accounts on the site and used it regularly. The members, who did not have accounts, had intended to create them for some time and using the SNS for the capstone course gave them the incentive to do so. Once the group members had added each other as friends, one of them set up a closed Facebook group and each member was added and given administrative permissions. Administrative permissions were given to all members as it allowed them to have identical group privileges; this gave them control to the membership and content of the group. Administrators can also send messages to the group, appoint other administrators and edit group info and settings.

Once the group was set up, Facebook was used to communicate group decisions. For example, when deciding on a logo for the group, several images were posted; members then posted their opinion as comments, after which a consensus was reached. Facebook was also used for group discussions, such as status updates, solution updates and requirements gathering. An example of this is during the initial phases of the project, in the user requirements gathering phase, some members were not able to attend client meetings and therefore posted any questions they wanted to ask the client in a discussion thread. Once the meeting was over, members who attended the meeting updated the discussion with the client’s responses. This highlights the presence of asynchronous learning; members who were unable to attend the meetings had the option of posting up questions, and reviewing the answers at times that better suited them. The online collaboration had no time frames and allowed group members to review and post comments outside the constraints of time and place (Mayadas 1997).

### **Summer Internship**

The summer internship is a scheme in which undergraduate students are invited to apply to undertake a two-month internship within the school and selections are based on academic merit. The interns are assigned a project to complete under the guidance of academic supervisors. Although it appears that the interns are not involved in group-based learning, this is not true. In contrast to capstone supervisors, intern supervisors are much more involved with their projects and interns. Additionally, intern supervisors tend to have greater motivation as they devise and put forth their own projects for interns to undertake. Thus, the intern supervisors take a very hands-on approach to the project (as a rough comparison, capstone supervisors meet their groups once per week whereas intern supervisors meet their interns multiple times per week). As with the capstone project, by taking a metacognitive approach to supervision, it is possible for cooperative learning to occur.

A constructionist (and, thus, a constructivist) approach is used in the internship since the interns need to apply and build upon the knowledge they acquired during their studies to their projects and create artefacts. The

artefacts built vary, depending on their projects. Some example of artefacts create are an iPhone app, a number of video casts (vodcasts), a mashup, and an investigative report.

To support the social aspect of the internship, an Elgg SNS was set up specifically for it. The SNS was the primary mode of electronic communication between the internship coordinator and the interns. Additionally, the interns also communicated to each other through the SNS and some supervisors (the first and third authors of this paper) also used the SNS to manage their projects.

The Elgg SNS was chosen as it could be configured to provide a closed, secure and safe environment that the interns could use and experiment within. This was an important factor since, as far as the authors are aware, it was the first trial of an SNS in the school.

The Elgg 1.6.1 package, which came with a variety of plug-ins that can be enabled, including files, profiles, pages (wiki), blogs, the wire (microblogging), social bookmarking, etc., was installed on a virtual server in the school. As part of the installation and configuration, all of the default plug-ins were enabled. Additionally, plug-ins (chat, events and site access) from the Elgg community were added to provide specific tools that would be useful.

The chat<sup>6</sup> plug-in added an extra mode of communication between the members, allowing them to instantly message each other when required. The events<sup>7</sup> plug-in was installed to allow the interns to plan deadlines as well as plan lunches and social activities with each other. The site access<sup>8</sup> plug-in was installed to disable public registration and only allow invited users to join, thus, creating a 'walled garden'.

The capstone group used Facebook and the interns used Elgg, and although these are two different SNSs, they are based on the same theoretical description of an SNS. The different implementations were very close and had little variations. For example, sending posting a message is a very similar process on both Facebook and Elgg. These differences are marginal.

## METHODOLOGY

An exploratory case study approach was adopted for the research. This approach is appropriate as we wished to carry out an idiographic study to investigate a contemporary phenomenon in its real-life context (Benbasat et al. 1987; Yin 1981). We focused our investigation on how the participants used the social networking sites given their particular project-based learning environments, and answering "how" questions is a particular strength of the case study approach (Yin 1981).

The adopted approach involved both face-to-face interviews and email interviews. This particular approach was selected because of a limited number of potential candidates available for the study. As some of the potential candidates were in teacher-student relationships with some of the researchers, to avoid introducing bias in the data collected, a suitable independent third-party conducted the interviews. The independent third-party interviewer de-identified the data before handing it to the researchers for further analysis<sup>9</sup>.

The combination of face-to-face and email interviews was used to collect data about the use of SNSs in two different project-based learning environments. In particular, two interns were interviewed face-to-face from the 2010 internship and five students from a group who undertook the capstone course in semester 2 of 2009 were sent open-ended interview questions through email. The capstone group members were emailed the questions since it was not possible to conduct face-to-face interviews due to geographical distance and time availability restrictions. However, to simulate the interview process, once they returned their replies, further questioning and clarification were communicated through email if necessary.

In the 2010 internship, although all the interns used the Elgg SNS set up specifically for the internship, only four interns used it explicitly for project management purposes. This included communicating with their supervisors through Elgg. Thus, only those four interns were considered for this research. Of the four only two volunteered to participate in the research.

We selected this particular capstone group for our research as they chose to use Facebook to manage their project. As the Facebook-based management of the project only involved the students and not their supervisor, only the students were considered to be part of this research. The group contained six students and five of them

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<sup>6</sup> <http://community.elgg.org/mod/plugins/read.php?guid=384910>

<sup>7</sup> <http://community.elgg.org/pg/plugins/kevin/read/384926?release=273108>

<sup>8</sup> <http://community.elgg.org/pg/plugins/shellcode/read/384611/site-access>

<sup>9</sup> This research was conducted with ethics approval from the RMIT Business College Human Ethics Advisory Network under register number 1000121.

volunteered to participate. The interview questions were emailed to the capstone group members as face-to-face interviews could not be carried out due to conflicting schedules and geographical distance.

A summary of the participants is shown in Table 1.

Table 1. Summary of participants

Participant ID	SNS Used	Learning Environment
INT03	Elgg	Internship
INT04	Elgg	Internship
CAP01	Facebook	Capstone Course
CAP02	Facebook	Capstone Course
CAP03	Facebook	Capstone Course
CAP04	Facebook	Capstone Course
CAP05	Facebook	Capstone Course

Participants from the internship were assigned participant IDs with a prefix of “INT” whilst participants from the capstone course were assigned participant IDs with prefixes of “CAP”. The numbers following the prefixes have no meaningful bearing. As mentioned previously (refer to “Project-based Learning Environments”), all internship participants used the Elgg SNS whilst capstone course participants used Facebook.

A qualitative analysis of the data collected is presented in the following section.

## RESULTS AND DISCUSSION

We analysed the participants’ responses on two levels. Firstly, the participants’ use of the SNSs in general were analyzed, followed by an analysis of their usage of individual tools of the SNSs.

### General SNS usage

Although the two project-based learning environments described (refer to “Project-based Learning Environments”) appear to be similar, there are a number of fundamental differences that affect how the learners (i.e., students’ and interns’) use the SNS. In this section, these differences are explored and usage of SNSs in general (i.e., not specific implementations such as Facebook or Elgg) is examined.

The fundamental differences between the two aforementioned project-based learning environments can be determined on the dimensions of: (1) group size, (2) geographical distance, (3) temporal separation, and (4) project duration.

Group size is the most obvious difference. The capstone group had six members (all students) whilst the internship groups had three members (one student intern and two supervisors). Surprisingly, the group size did not seem to have any noticeable effect on the participants’ perception of their usage of the SNS. However, the combination of geographical distance, temporal separation, and project duration, did have an effect on the participants’ perception of their usage of the SNSs.

The interns had eight-week projects, were located either in the same or nearby offices, and spent at least five hours per day, five days a week together. The capstone group members had a sixteen-week project, met between two to four times per week, and spent between two to four hours together per week. That is, compared to the capstone group members, the interns had shorter project durations, were geographical closer, and had less temporal separation. The interns’ project-based learning experience was more intense and this affected how they utilized the SNS.

The interns reported that they used the SNS multiple times per day and as frequently as every ten minutes, whereas the usage frequency for the capstone group members ranged between daily to once per week. The interns found the SNS useful as it allowed them almost instant access to information, each other, and to their supervisors, who were more geographically distant to them (i.e., on the same floor, but opposite side of the building). This was convenient and worked well as interns and supervisors were always logged on when they were working at a computer and they had similar working schedules (i.e., they shared the same temporal space, but different geographical space). In contrast, the capstone group members, who did not share the same temporal

or geographical space as often, found the SNS to be useful for asynchronous learning and outside of university hours and contact. For example, one capstone group member stated, “it [the use of the SNS] enabled me to understand where group members were at in terms of issues or problems and then think about what do to before our next meeting.” Both interns and capstone group members found the SNS to be useful for sharing of information.

An important part of the adoption of technology is the perceived ease of use. Notably, none of the participants were trained to use SNSs, but they “just went on it [the SNS] straight away [sic]” (even though user documentation was provided for the interns). One of the capstone group members “used Google [to research] on how to create groups.” As there were no reported problems with the SNSs, this shows that SNSs are intuitive and easy-to-use. One capstone group member stated, “No training was undertaken to use Facebook. All members were competent using Facebook and had no issues regarding the use of the tool.”

When asked how the SNS affected their understanding or outcome of their projects, three caveats emerged from both the interns’ and capstone group members’ experiences. During the internship, the SNS contained a small number of users (less than 15) and one intern noted that although the discussion board on the SNS is a collaborative tool, it was not really helpful because there were not many users on the SNS to make contributions.

One capstone group member stated, “it was a lot easier to ask questions on a discussion board then [sic] have to ask in a face to face [sic] meeting with everyone yelling over the top of each other”. This statement appeared to be counter-intuitive as most of the participants stated that the SNS was useful for communication, but they preferred face-to-face interactions for discussions or dissemination of large amounts of or complex information. When the statement was further explored, it was discovered that this arose from the nature of the meetings and the group composition. The group meetings were, on many instances, particularly at the start and middle of the project, quite heated and there were a number of disagreements on certain issues. The vocal members of the group (there were three of them) voiced their opinions and argued openly whilst the other members tended to take a non-committal stance when their opinion was asked for. However, unresolved issues were left open at the end of the meetings and the discussion continued online. It seemed that the asynchronous mode of online discussion board, in particular its innate turn-taking nature, was beneficial for the less vocal members who tended to utilize the medium more to voice their opinions rather than in face-to-face situations.

The third caveat was from an intern who mentioned, “Someone put something on the post [micro-blogging] that was very helpful for me. I think he was doing something that was related [to what I was doing]”. As the interns did not explicitly collaborate on their projects, this is an example of a benefit of social learning supported by an SNS (even though there was a small user base). If it were not for the SNS, the intern might not have stumbled across the other intern’s knowledge. In a sense, this can be termed “serendipitous learning”.

Although all participants acknowledge the usefulness of SNSs and recommended them in teaching environments, “[they would] be useful for students to be able to talk to the lecturers and tutors quickly”, and group-based environments, “any courses [sic] that requires group contribution can be recommended to use ... [an SNS]. It provides a convenient place where group members can communicate to each other and share ideas”, it seems that SNSs have limited use in project-based learning environments. When asked if they learnt something through the SNS that they would not have learnt otherwise, all participants responded negatively. Thus, SNSs in project-based learning can be summarized as useful and convenient, but not essential. The particular benefits of using SNSs in such environments are that they create greater opportunities for collaboration and “serendipitous learning”.

### **SNS tool usage**

SNSs are powerful platforms for web-based collaboration, communication, and socializing. Not only are SNSs themselves a Web 2.0 technology, they can also incorporate other Web 2.0 technologies within themselves as described in “*Web 2.0 and Social Network Sites*”. These Web 2.0 technologies have different educational purposes, however, they all tend to support social learning, constructivism, and constructionism. In this section, we analyze the participants’ responses and examine which tools were most useful for the two different project-based learning environments.

Elgg provides all of the tools that are considered in this research (refer to Table 2). Facebook, however, does not provide blogs, social bookmarks, or wikis. Thus, interns who participated in the research were asked to rate how often they used each tool provided in Elgg while the capstone group members were asked to rate how often they used each tool that Facebook provided and rate how useful they thought the tools which Facebook did not provide might be.

All participants specified their frequency of use on a five-point Likert scale. Capstone group members also rated their perceived usefulness of tools that Facebook does not provide on a five-point Likert scale.

The ratings provided by both interns and capstone group members for existing tools provided by Elgg and Facebook are shown in Table 2 and the capstone group members' rating of perceived usefulness of tools not provided by Facebook are presented in

Table 3. These figures are provided to supplement the previously presented analysis and to give a more encompassing view of the participants' use and perceptions of SNSs. They are not provided for statistical significance purposes.

Table 2. Perceived frequency of use of SNS tools<sup>10</sup>.

Tool	Facebook Imp.	Elgg Imp.	INT 03	INT 04	INT AVG	CAP 01	CAP 02	CAP 03	CAP 04	CAP 05	CAP AVG
Blog	N/A	Blog	4	3	3.5	N/A	N/A	N/A	N/A	N/A	N/A
Discussion Board	Discussions	Group Discussion	3	4	3.5	3	3	5	1	5	3.4
Profile Post	The Wall	Message Board	2	5	3.5	3	2	3	1	5	2.8
File Sharing	Photos/Images	Files	3	5	4.0	3	1	1	1	4	2.0
Micro-blogging	Status Update	The Wire	5	5	5.0	1	3	1	2	3	2.0
Social Bookmarks	N/A	Bookmarks	2	4	3.0	N/A	N/A	N/A	N/A	N/A	N/A
Calendar	Events	Event Calendar	1	2	1.5	1	2	3	3	5	2.8
Wiki	N/A	Pages	3	4	3.5	N/A	N/A	N/A		N/A	N/A
Instant Messaging	Chat	Chat	1	2	1.5	1	3	1	5	5	3.0

Table 3. Perceived usefulness of tools not provided by Facebook<sup>11</sup>.

Tool	CAP01	CAP02	CAP03	CAP04	CAP05	CAP AVG
Blog	3	3	2	1	3	2.4
Social Bookmarking	4	3	3	1	4	3.0
Wiki	4	3	3	1	5	3.2

As part of the internship, interns were required to maintain a reflective blog. They were assigned guiding questions to assist them with reflecting on their projects and made entries once a week. Thus, from the two interns' responses to the usage frequency of blogs, a rating of three ("Occasionally") or 4 ("Sometimes") can be interpreted to be once-per-week.

Fitting in with the interns' theme of quick access to information, to each other, and to their supervisors, tools such as discussion boards, profile posts, file sharing, micro-blogging, and social bookmarks were found to be quite useful (refer to Table 2). It should be noted that when the interns were using the closed SNS, they were the exclusive users on it. Thus, they used micro-blogging to communicate to each other in circumstances in which it would normally be more appropriate to use a discussion board (i.e., in contrast, the capstone group members did not use micro-blogging as much to communicate project discussions as they used Facebook, which is open to the public).

Instant messaging was not used frequently. This is likely because of the proximity, both in terms of the shared geographical and temporal space, of the interns and supervisors, which meant that they could easily communicate face-to-face. The calendar tool was also not used frequently and this likely because, due to the short duration of the project and small group size, it was easy to keep track of deadlines (of which there were not many) without the use of the calendar.

There is not much variance in the interns' responses apart from social bookmarks and profile posts. The variance on usage of social bookmarks can be attributed to the type of projects the interns were undertaking. The intern who undertook an "investigative" project was required to bookmark findings more often, whereas the other intern, who undertook an "implementation" project, did not use the bookmark as much. The profile posts are likely related to the personality of the interns. The more social intern tended to use this tool more often.

<sup>10</sup> Scale: 1 = Never, 2 = Rarely, 3 = Occasionally, 4 = Sometimes, 5 = Regularly.

<sup>11</sup> Scale: 1 = Not useful, 2 = Somewhat useful, 3 = Useful, 4 = Very useful, 5 = Extremely useful.

The discussion board was the most frequently used tool for the capstone group members, followed by instant messaging. As they did not often share the same geographical and temporal space, asynchronous discussions through the discussion board and, when possible, synchronous communication (i.e., instant messaging) was frequent. Tools such as profile posts and the calendar were also frequently used. Profile posts forms part of asynchronous conversations, however, it is used for shorter discussions (than on the discussion boards) or for quick communication of information. The calendar was more useful for the capstone group members due to the longer duration of their project and their larger group size; it assisted in group coordination.

The capstone group members did not use file sharing and micro-blogging frequently. Facebook file sharing is limited to the sharing of photos or images, and this likely restricted its usefulness for the capstone group members. Micro-blogging on such a large and public space has limited uses for project-based learning as project details are usually reserved for internal discussion so as not to mix with the social aspect of Facebook.

## CONCLUSION

We examined the use of SNSs to support the social aspect of two different project-based learning environments. In one environment, namely the summer internship (refer to "*Summer Internship*"), learners were involved in projects of short durations, were in close geographical proximity, and had little temporal separation. This was a more intense experience compared to the other environment, the capstone project (refer to "*Capstone course*"), in which learners were involved in a project twice as long as the interns, were not as geographically close, and had greater temporal separation. These differences in the learning environment led to different uses of the SNSs.

The interns mainly used the SNS for quick access to information, each other, and their supervisors. They used the SNS frequently (between "multiple times per day" to "every ten minutes"). SNS tools such as discussion boards, profile posts, file sharing, micro-blogging, and social bookmarks were found to be useful while other tools such as instant messaging and the calendar was not used often.

The capstone group members, who were more geographically and temporally dispersed, mainly used the SNS for asynchronous learning. They used the SNS less frequently than the interns (ranging between "daily" to "once a week"). The discussion board was the most frequently used tool. Other tools such as instant messaging, profile posts, and the calendar were also frequently used.

Although the SNSs were found to be useful and convenient, both interns and capstone group members stated that they were not essential. Particular benefits of using SNSs in project-based learning environments are that they create greater opportunities for collaboration and serendipitous learning. The fact that the SNSs were not essential is supported by both interns and capstone group members stating that they found the variety of the communication modes present (i.e., face-to-face, phone, discussion board, instant messaging, etc.) to be useful and allowed for flexible usage in different situations.

Thus, the intensity, as defined along the dimensions of group size, geographical distance, temporal separation, and project duration (refer to "Result and Discussions"), affects how learners use an SNS. Our preliminary findings show that learners in an intense project-based learning environment tend to use SNSs for quick access to resources (such as information, each other, and their supervisors). However, in less intense environments, learners use the SNS more for asynchronous learning and communication. In both environments, learners found the SNS easy to use and useful for sharing information. The learners' attitude towards the use of SNSs in project-based learning environments can be summarized as "useful and convenient, but not essential."

The main limitation of this work is the small number of participants involved. The study only used participants from two project-based learning environments, two summer internship groups and a group from a capstone course. Due to the small number of participants involved, the results of the study should not be generalized and are limited to this specific study. Another limitation of the study is the use of two similar but different social networking sites (SNSs). To ensure better comparability, the same SNS should be used in future work.

Due to these limitations, and as these are preliminary results of an exploratory research, more work is required to further confirm these findings. Future work should include expanding the research to include a greater number of participants, other appropriate courses, and other project-based learning environments with various levels of intensity. The term "intensity" will also need to be more finely defined in order to be able to adequately compare varying degrees of "project intensity".

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