THE USE OF SOCIAL NETWORK SITES IN A GLOBAL ENGINEERING DESIGN PROJECT

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Abstract

The global design project challenges students from three European universities to work in engineering design teams on the development of a product. To execute the design process, students have chosen to utilise social network sites as a platform for communication and collaboration. The aim of the study was to investigate how students were utilising social network sites as part of their collaborative work during the global design project and their views on the level of support given. A survey and semi-formal interviews were used to collect data on views and the use of social network sites. The study reveals: (1) the popularity of different social network sites for social and academic tasks, (2) the expectation of support students' and academics' think is required, and (3) a need for greater guidance in the use of social network sites. The use of social network sites by students' is discussed with a focus on how they can be better supported in future projects. This paper proposes that students' and academic staff require guidance on the best practices for using social network sites in global design projects to support students' education.

Keywords: Collaborative design, Design education, Knowledge management, Teamwork, Social media

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Please cite this paper as:
Surnames, Initials: *Title of paper*. In: Proceedings of the 21st International Conference on Engineering Design (ICED17), Vol. 9: Design Education, Vancouver, Canada, 21.-25.08.2017.

1 INTRODUCTION AND STATE OF THE ART

Students who once used traditional industry communication technology for design projects, such as E-mail, are now utilising social network sites (Brisco et al., 2016). This research investigates how current students utilise social network sites within a university environment, quantifies their popularity for conducting academic work and gathers the opinions of their potential in the future.

Social network sites are a category of social media (Lietsala and Sirkkunen, 2010) allowing their users to share content and conduct social tasks such as organising gatherings and conversing. Boyd and Ellison (2007), define a social network sites as allowing individuals to "(1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system". An alternative perspective is found in the simplicity of Cross (2014), who defines the only criterion of a social network site is to "enable people to connect or network with one another through the use of profile pages". Both are valid and can encompass many websites which are not colloquially referred to as social network sites, such as messengers, group management tools and photo sharing sites. In the authors experience, social network sites could be referred to in academia as (but are not limited to) web 2.0, social software (in an industry context) and groupware with social functionality. In some cases, these descriptions are more accurate depending on the context in which the technology is being used. Boyd and Ellison (2007), go onto state that "the nature and nomenclature of these connections may vary from site to site", to indicate that there is some flexibility when it comes to defining what a social network site does and must accomplish. The authors of this paper suggest the view that a social network site is defined by its ability to allow users to build a network and engage in communication. This must be done using social media principles encouraging growth of the network and allowing ease of sharing. This definition of a social network site can include apps which are only accessible on mobile devices and specialised platforms, such as social network sites whose primary function is the sharing of photographs.

Social network sites have become popular through personal and social communication. In addition, "social networks have become increasingly popular with students participating in the global design class for their ease of use, ubiquity and students familiarity with the systems" (Mamo et al., 2015). They integrate with students' lives allowing them to access a network of friends, family and others to receive the information they seek amongst other activities. Social network sites offer an ease of communication therefore it is understandable that students would utilise the technology for academic work also. This is reported in Johri (2014), where the most frequent task for students using social network sites was seeking information related to the topic of school work.

Facebook is the world's most popular social network site (Statista, 2017). The potential of Facebook as a teamwork tool allows groups of like-minded people to discuss a common topic. Facebook allows anyone using the social network site to create a public or private group with others to engage in conversation in the form of text, image, audio and video. In the context of design engineering education this could be used for year groups, class groups, team groups or even society pages. Hurn (2012), investigated the use of web 2.0 technology, particularly blogs and social network sites, in product design higher education. Of interest is that over 70% of students in his survey reported using social software for discussing project work. Considering the popularity of these websites for academic work this raises a question; are students being supported appropriately in their use of social network sites?

Sheriff (2012), reported on the use of web 2.0 applications by academic staff in an engineering department. He found through a survey that academic staff do not use social networking platforms and do not believe that they require training on social networking. Sheriff also reported that approximately 65% of students use social network platforms socially and do not believe they require training to assist them in an academic setting. This mirrors the previous point raised by Hurn and adds if it is decided that students require guidance on the use of social network platforms, how should this be delivered?

If students are going to use these tools and they prefer to do so, it is important to understand why and support this behaviour appropriately. "We propose that the proliferation of Web 2.0 technologies and their incorporation into the learning and teaching environment means that academic staff and students will need to develop skills in digital literacy to participate effectively in distributed project-based collaborative work" (Bohemia and Ghassan, 2012). Social network sites offer a novel way for students to conduct work. Gopsill et al. (2014) suggested "A Social Media tool that has been built specifically to support that type of Engineering Design Communication has the potential to provide a more

collaborative method of communication" when comparing the features and functionality of E-mail. As students are already familiar with the technology, there are fewer difficulties typically associated with adopting new technologies, such as training and feature awareness. The functionality of social network sites allows for ease of communication and notification within a network which could contribute towards solving problems of awareness, sharing, discussion and decision making within distributed team work.

1.1 Global design project

The global design project 2016 was an example of a class where students challenged typical learning environments and utilised social network sites in the communication and collaboration of student work. The project challenged students to design a product which enables mobile working whilst traveling, however, this paper does not report on the outcomes of the students' design project work. This paper reports on a study investigating the use of social network sites by students in the context of the global design project. The project was undertaken by students from the University of Strathclyde, City University of London and the University of Malta. The twelve teams involved were made up of students from multi-disciplinary backgrounds in: product design engineering, product design innovation, global innovation management, mechanical engineering and electrical engineering. A typical team was made up of ten students from a mixture of all universities.

As part of the global design project 2016, students have been encouraged to explore the functionality that social network sites can offer to overcome barriers in the distributed collaborative design process. Lectures were delivered to all students synchronously using a telepresence system and adobe connect web conferencing software. The lectures introduced the challenges associated with distributed collaboration including a lecture presenting guidelines for knowledge management and social network site use in distributed teamwork. Guidelines were based on Brisco et al. (2016) with the aim to encourage students to think about their implementation of social network sites and other collaborative tools and techniques within their projects. The global design project offers students the experience of distributed working in an educational environment. "The global design class is important within Product Design Education as it introduces the problems associated with globally distributed teamwork which prepares them (students) for future careers" (Wodehouse et al., 2008).

2 RESEARCH METHOD AND METHODOLOGY

This study took place during the three months which the global design project ran. The aim of the study was to investigate how students were utilising social network sites as part of their work during the global design project, their views on the level of support given and their opinions on the future use of the technology. This work contributes towards a larger study investigating how social network sites can be better supported during distributed project work. Students at the University of Strathclyde were selected to take part in the study as they are all involved with engineering design disciplines and exclude the views of mechanical and electrical engineering students who may have different cultural views. A survey and semi-structured team interviews were conducted to collect data on the use of social network sites and students' and academics' opinion. 34 students were involved in the study enrolled in the final year of a masters' degree or final year of a bachelors' degree. Students were aged between twenty-one and thirty-two with the mean age being twenty-four. Five academic staff were involved in the global design project 2016. As part of the projects academic staff have the role of mentoring individual teams. All staff have experience working with students in previous years of the global design project.

The authors take a mixed methods approach focused on understanding the behaviour presented by students which has been observed and documented. To evaluate the responses and conduct analysis, Excel and Nvivo were used to create documents, link findings and manage the outputs from analysis. These tools were beneficial for both quantitative and qualitative results in allowing the documentation of the team's activities in a rigorous and systematic way, and to find commonalities and differences between the views of students' and academics', allowing the linking of student opinions with their reported behaviour.

3 RESULTS AND ANALASYS

This section details the results of a survey and semi-structured interviews with students and academics of the global design class. The survey questions were designed to investigate: how students use social

network sites currently in their daily lives, if this relates to academic work and the role that academia has and should play in supporting engineering design students' education.

3.1 Use of social network sites by students

Figure 1 displays a comparison of data collected by students of the global design project on their daily social network use. 34 students participated in the survey. Students were asked to list the social network sites they used and indicate the purpose that they used it for.

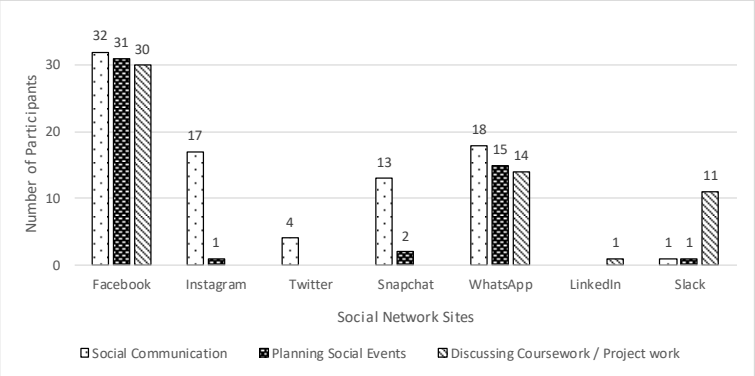

Figure 1. Comparison between the use of social network sites for personal communication, for the social task of planning an event and the academic task of discussing coursework / project work by students

Three purposes for using social network sites are reported in Figure 1. Social communication refers to activities such as conversing with friends and sharing artefacts such as pictures and videos. Planning social events is understood as a social task requiring organisation. Discussing coursework / project work is understood as an academic task allowing for decisions to be made (in this context design decisions) and facilitating education through project based learning. Most students, 94%, responded that they use the social network site Facebook for social communication on a daily basis. Other popular social network sites for social use include Instagram, Snapchat and WhatsApp. The gap between the most popular social network site and the second indicates the popularity which Facebook has gained in a social context with students of the global design class. Students reported on the popularity of social network sites Facebook and WhatsApp for conducting the social task of planning social events. Of users for social communication purposes, 97% of Facebook and 83% of WhatsApp users utilised the social network sites for planning social events. Students reported the use of Facebook, WhatsApp and Slack for discussing coursework / project work. Of users for social communication purposes, 94% of Facebook and 78% of WhatsApp users utilised the social network sites for discussing coursework / project work. A minority of users reported the use of Slack for discussing coursework / project work. The popularity of Facebook shows that it is an all-encompassing tool which can meet the needs of multiple situations. Through the identification of the use of social network sites for academic purposes, it is important to ask what they do, how they do it and why students choose to use them.

Seven social network sites were identified as used by students in this study. These are listed in Table 1 and a description is given of their nature. Facebook was identified as the most popular social network site in Figure 1. It is important to understand that Facebook is a social network site which encompasses multiple channels of communication which are listed in Table 1. Status updates are the main form of communication of which the Facebook platform grew upon. Yet, for academic purposes Facebook groups and Facebook messenger are also very popular. Facebook groups allow teams the ability to collaborate and share artefacts in a separate or private space, with notifications to alert team members of engagement. Facebook groups act in the style of a wiki with multiple threads of conversation facilitating discussion around certain topics. Facebook messenger acts like a traditional instant messenger client with one thread of conversation. This can be one-on-one messaging or group messaging. Facebook messenger can be installed on a mobile device as a separate app to Facebook and does not require a Facebook account to use. Facebook messenger and its instant messenger style is more popular for conducting quick conversations, such as when asking closed questions according to interviews, but not for storing data or archiving. Facebook groups, in comparison, are better suited as a

knowledge management tool according to students because they offer the ability to store data, search and access it.

Table 1. Social Network Sites reported in this study and a description of their nature

Social Network Site	Description
Facebook	Is a comprehensive platform offering multiple ways of conversing and sharing including: status updates, group pages and instant messenger.
Instagram	Primarily a photo sharing platform including public, semi-public and private channels.
Twitter	Originally a microblogging website, Twitter has developed into a fully-fledged social network site. Twitter restricts status updates to a 140-character limit.
Snapchat	Primarily a private photo sharing platform only available on mobile devices. Images are deleted after they have been viewed.
WhatsApp	An instant messenger platform only available on mobile devices. Initially popular in Europe and South America but has spread around the globe.
LinkedIn	A platform for professionals to network within a professional context as opposed to an informal context. This offers the ability to display a comprehensive CV and share status updates on work related stories.
Slack	A team discussion platform which utilises hashtags to code conversations with the purpose to group and search conversations easily.

Figure 2 displays the use of devices to access social network sites by participants of the global design project. Students were asked to list the devices they use to access social network sites. Smartphone (97%) and laptop (100%) were the most popular devices used. This is comparable with results by Klimova and Poulova (2015), who reported 89% of students in their study own a smartphone and notebook. This is interesting when considering distributed design and the cultural differences related to the adoption of device use and social network sites. Tablet and Desktop PC devices were less popular with 18% of users reporting the use of a Tablet and the same for a Desktop PC.

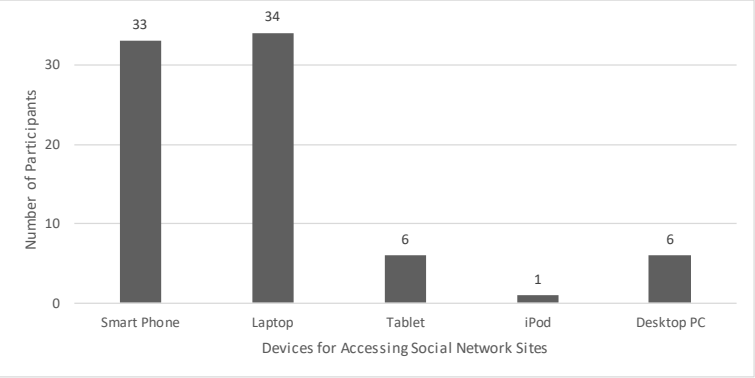

Figure 2. Devices used by students to access social network sites daily

Students were asked to list the communication tools which they used as part of the global design project for their project work. Figure 3 displays the top five tools identified which are categorised as a social network site platform, Video conference platform, cloud storage tool and E-mail. Facebook was identified as the most popular software required for globally distributed collaboration identified by 61% of students. 44% of students identified Skype and 35% identified E-mail as required tools. Only 21% identified google drive and the same for WhatsApp as required software for globally distributed collaboration. The tools support the project in different ways: social network sites offer a space for organisation, discussion and sharing; video conference tools offer the opportunity for face-to-face communication and for conducting collaborative activities, and cloud storage offer a place for team members to save, share and access shared information at their demand. These tools were identified by Mamo et al. (2015) and are still able to fulfil teams requirements.

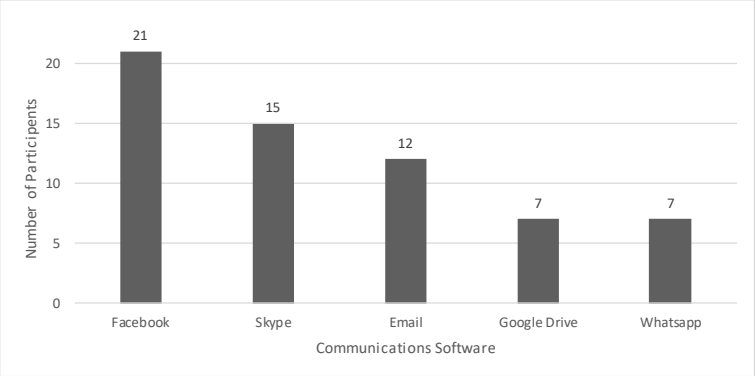

Figure 3. Top five communication tools used by students during the global design project

3.2 Student views on the use of social network sites in an academic setting

Figure 4 displays the response by students of the global design project to five questions on the use of social network sites in an academic setting and one question on its use by students in future careers. Students responded positively towards the use of social network sites. 80% of students responded that they feel supported in their use of social network sites, 71% of students believe that academic staff of the global design project have the appropriate attitudes and 80% of students expected to use social network sites as part of their future career. However, 53% of students believe that academic staff should not communicate with them using social network platforms, 50% were unsure if academic staff require training on the use of social network sites and Students had mixed views on whether academic staff were capable of teaching best practices on the use of social network sites with most favouring yes at 35%. The mixed opinions of students suggest that although students feel supported in their use of social network sites, perhaps more guidance is required in best practices to prepare students.

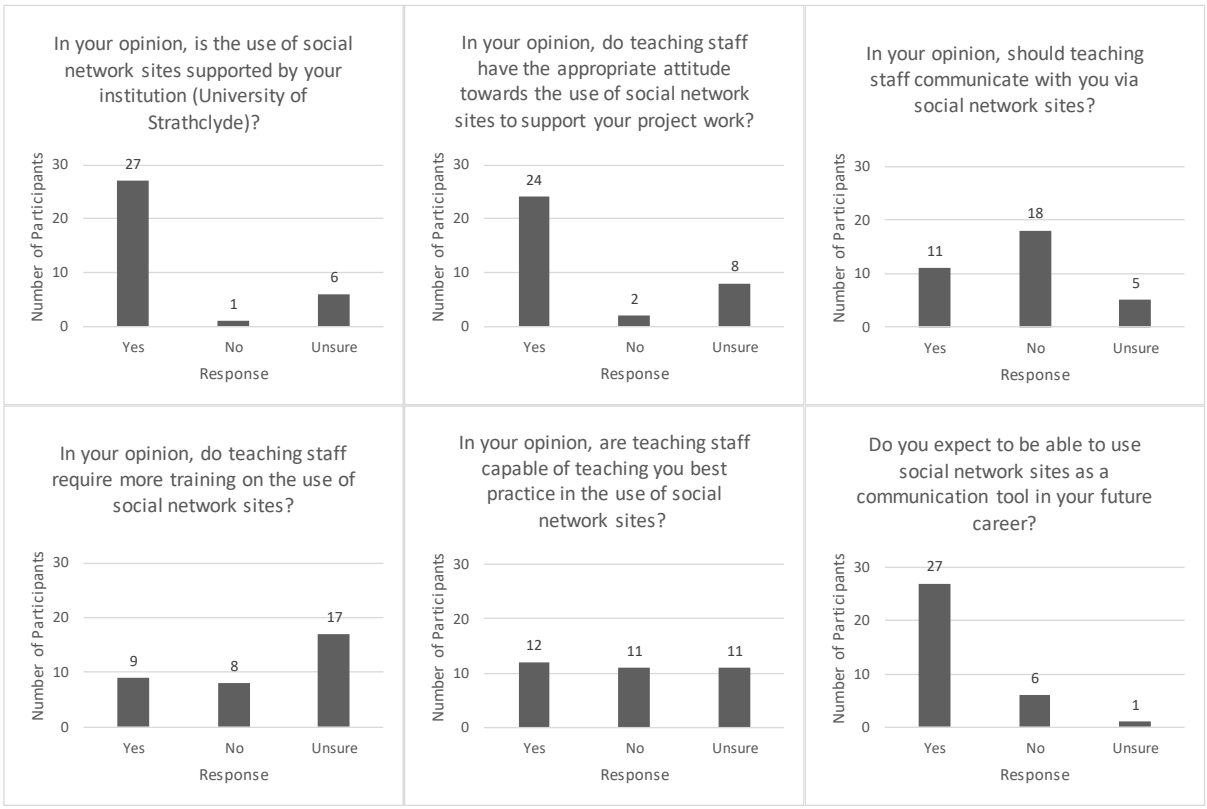

Figure 4. Survey response from students of the global design project on the use of social network sites in an academic environment and in future careers

3.3 Academic views on the use of social network sites in an academic setting

Figure 5 displays the response by academic staff of the global design project to three questions on the use of social network sites in an academic setting and one question on its use in industry. The responses to all questions were mixed with little consensus. Most academic staff believe that they do not have the knowledge to teach students best practices. This would support the view that some form of guidance is required. A mixed response was given to the question on the requirement of training which suggests that staff are unsure on how this guidance should be delivered. Finally, the majority of staff did not respond positively on the use of social network sites to communicate with students or as a common tool in industry.

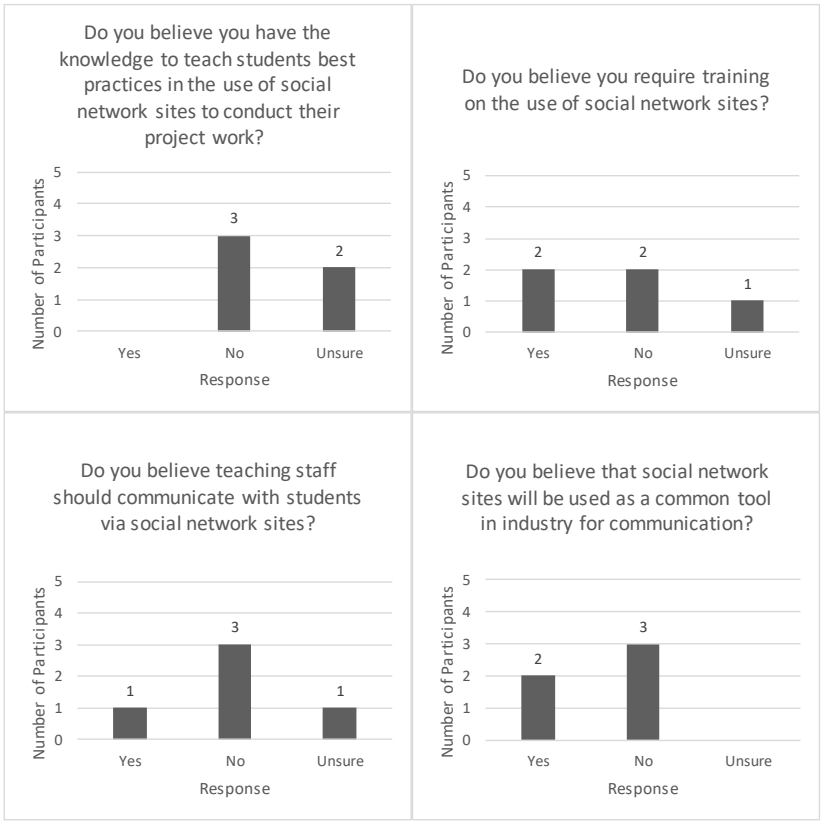

Figure 5. Survey response from academic staff of the global design project on the use of social network sites in an academic environment and in industry

3.4 Findings from semi-structured interviews

To supplement the findings of the survey and add context to the results, semi-structured interviews were conducted. During interviews students clarified that two channels of communication were used on the social network site Facebook. These were a private group page and an instant messenger group. The group page was used for managing team members and making design decisions, and the messenger was used for quick questions. The survey identified that students use Facebook, Whatsapp and Slack for conducting academic work (Figure 1). Through interviews this was clarified as tasks such as organisation of work and team members, making design decisions on the progress of the concept development and sharing design data such as CAD files, documents and images. Students who used Slack for their projects initially identified it as a more organised tool than their experience with Facebook group messenger. However, as the projects progressed the benefits of Slack were negated when team members mismanaged the labelling of data and artefacts became difficult to locate after the fact. E-mail was identified as the third communication tool student used (Figure 3). However, during interviews it was identified that E-mail was not used after the first week. Students identified that they do not wish to be contacted by academic staff on social network sites (Figure 4) for privacy reasons and they felt that they would be constantly judged and assessed on their social network site interactions. Students identified in the survey that students were unsure if academic staff were the best people to teach them best practices in the use of social network sites (Figure 4). Students clarified their position indicating

that they believe they have greater experience with the functionality and greater practical knowledge of social network sites. Finally, students stressed the importance of the integration social network sites have with their daily lives and to adopt a different tool for project work would be an inconvenience.

4 DISCUSSION

The discussion section takes the results and interprets them to understand what we can learn to support future global design classes. The discussion points are supplemented with key findings from interviews.

4.1 Use of social network site by students

The popularity of social network sites was split between more popular sites and less popular sites. Facebook was clearly the most popular social network site of students surveyed (Figure 1) with only two of 34 students reporting not regularly using the social network site for social communication, but they did have Facebook accounts. In comparison, Hurn (2012), reported 50% of students use Facebook on a regular basis in his study, and approximately 65% of students reported using social networking sites for social purposes in Sheriff (2012). This could indicate that in the few years since the other studies, the adoption of Facebook has increased, or possibly that students of the global design project at the University of Strathclyde are more engaged in social network platforms. Of the students who use Facebook on a regular basis for social communication, 94% reported using the website for conducting academic work (Figure 1). During interviews this was clarified as tasks such as organisation of work and team members, making design decisions on the progress of the concept development and sharing design data such as CAD files, documents and images.

WhatsApp was another popular social network platform identified for conducting academic work (Figure 1). Students reported using WhatsApp to conduct academic work such as asking simple closed questions and making minor design decisions in both synchronous and asynchronous group discussions. WhatsApp only offers instant message style communication and is not supported from a knowledge management perspective with tools for archiving, searching and multithreaded communication.

Slack is a social network site identified for conducting academic tasks but not social communication (Figure 1). Slack is structured to be used as a knowledge management tool, much in the way students use Facebook currently. This is the first year that the use of Slack has been reported in the global design project. Slack lacks existing integration in students' social lives which Facebook already has (Figure 1). In addition, it was reported during interviews that Slack can become frustrating to use when team members mismanage data. This may suggest why it was not adopted by more teams.

Other social network platforms were less popular amongst participants for social communication purposes compared to Facebook (Figure 1). This emphasises the ubiquity of the Facebook platform in the lives of the students engaging in the global design project. And if a new social network platform was created to support engineering design communication, such as in Gopsill et al. (2014), there is no evidence to suggest that students would choose to use this over popular social network sites which are integrated with their lives and their existing network of contacts.

Typical forms of communication in industry were not reported in students' communication methods apart from E-mail (Figure 3). Through interviews, it was discovered that E-mail was not used by any team after the first week. The reason for this is that teams were supplied with E-mail addresses to meet initially but students had no need for E-mail once they had established connections on social network sites. The global design project 2016 involved a large number of teams and many participants per team. Social network sites are well suited to accommodate the opinions of a large team through the use of multithreaded communication as identified in Gopsill et al. (2014).

4.2 Views on the use of social network site in an academic setting

The response from students to the survey was mostly unified in their views of the use of social network sites but mixed in terms of how the tools should be used in conjunction with teaching. Most students agreed that academic staff within the global design project have the appropriate attitudes towards the use of social network sites for project work and that their institution supports their use of social network sites (Figure 4). Students were encouraged to explore the benefits of many communication methods including social network sites, and this may suggest why they felt supported.

The majority of students responded that they do not wish to be contacted by academic staff on social network sites (Figure 4). Through interviews, it was deemed that this is for privacy reasons and although

work is conducted using social network sites it is at the same peer level. If academic staff were to engage students on social network sites, students indicated when interviewed that they fear they would be constantly assessed and judged. There are obvious privacy issues with sharing information on social network sites and the University of Strathclyde as an example discourage this. However, this means that the only data which is available for assessment is that which is reported by the students.

A mixed response was given to the question on whether academic staff are capable of teaching best practices for the use of social network sites (Figure 4). Through interviews students identified that they believe they have greater experience on the functionality and practical use of social network sites. This is true compared to the experience of the academic staff involved in the global design project. However, the staff involved have years of experience in computer-mediated communication and distributed collaborative design techniques by participating in previous years of the global design project, the DIDET project (Wodehouse et al., 2008) and the EGPR project (Vidovics et al., 2016) amongst others. Although staff might not have the practical knowledge of social network sites through their own admission (Figure 5), there is a substantial amount of information they can pass onto students conducting distributed design activities, such as knowledge management techniques and team relationship building. The education which academic staff can deliver has come from years of research into the field and experience with previous years' projects. This paper proposes that the same research and experience is required to deliver education on the use of social network sites in this context. This would be feasible as the phenomenon can be observed and tested. Although, specific guidance on the use of social network sites may become outdated over time, the reasons for the guidance will remain relevant and can be updated as technology evolves. The global design project offers a unique opportunity for students to experience distributed design in preparation of future careers which is a valuable experience for students' professional development (Wodehouse et al., 2008). This is currently achieved with guidance from supporting lectures however this study has identified a lack of guidance.

The majority of students reported that they were unsure whether academic staff require training on the use of social network sites (Figure 4). Staff agree that the role they play in supporting students' education does not require them to engage with them on social network sites. This supports the mixed views of academics on whether staff require training (Figure 5). Perhaps training is not required as indicated by the student and staff responses, but, the role of a set of guidelines could support student and academic education on social network site, their functionality and the greater role this plays in collaboration.

Students responded that they believe they will engage with social network sites as a communication tool in future careers (Figure 4). When asked during interviews, students explained that social network sites are integral to their daily lives and offer a convenience that other methods cannot. Conversely, academics were mixed in their opinion of social network sites use in industry (Figure 5). This gives an indication on the importance of educating students on the use of social network sites. This would suggest that the academic opinion on the usefulness of social network sites is changing in engineering education as more academics are aware of the prevalence of social network sites in academia and its benefits.

4.3 Limitations of the study and future work

This study was conducted with students of the global design project at the University of Strathclyde and academic staff involved in the global design project from all institutions. As such, it does not claim to represent any larger population. Academics or students who find themselves involved in a global design project may find a use of the data presented as the project is comparable to other classes offered at similar institutions. This data will contribute towards knowledge in larger studies and projects of similar institutions to gain a greater insight into social network use by engineering design student. This will be achieved through further studies and a series of workshops on distributed collaboration. It is important to note surveys reflect self-reported data which can be susceptible to individual bias and uncertainties. Despite this, questions were designed and tested to minimise confusion and misinterpretation of the questions. Future work will continue to investigate the use of social network sites in academic settings. The next steps for the authors are to investigate how social network sites are used in specific parts of the design process particularly when making design decisions.

5 CONCLUSIONS

This paper has documented the use of social network sites by students for academic communication during a global design project. The global design project challenges students of three European

universities to collaborate in teams on the design of a product. To facilitate the design process, students have chosen to utilise social network sites as a platform for communication and collaboration. A survey and semi-structured interviews were conducted. The study reveals: the popularity of different social network sites for social and academic tasks, a need for greater guidance in the use of social network sites and the expectation of support students and academic staff think is required within the global design project. Key issues on the implementation of social network sites are identified with a focus on how the technology might be better supported in future projects. The global design project allows students to experience the problems associated with distributed design and build their skills before moving into industry. The use of social network sites has grown in popularity both for social purposes and for academic work. It is important to learn about the phenomenon to ensure our teaching methods are suitable for current students. The global design project is one example of how social network sites are being used to support student to student collaboration in an effective, efficient and creative way.

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ACKNOWLEDGEMENTS

This work was supported by the EPSRC under Grant EP/M508159/1. Thanks to all the academic staff and students of the global design project 2016 for their contribution in the study.