USING *SLACK* FOR SYNCHRONOUS AND ASYNCHRONOUS COMMUNICATION IN A GLOBAL DESIGN PROJECT

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ABSTRACT
Innovations in technology and the growth of the global economy are changing the way companies work. With an increasing number of workers distributed across the world, the communication tools teams have traditionally used are transforming to suit these changes [1]. Design educators are aware of these changes and design students are responding by using communication tools familiar to them. This paper examines the use of the increasingly popular cloud-based team collaboration tool, *Slack* [2] in the context of a Global Design Project and assesses some of its benefits and drawbacks compared to other communication technologies available, including social media. Educators who seek to provide guidance for students, and students who seek to learn about tools that are increasingly being adopted by businesses that need to effectively communicate asynchronously will be interested in this assessment of *Slack* and this paper's recommendations for its application in similar work.

Keywords: A/synchronous communication, social media, Slack.

1   INTRODUCTION
How well information is understood and processed (cognition), and how people react and respond to communication is influenced by the quality of that communication [3]. Face-to-face communication has a different quality to e-communication. It allows team members to gain greater understanding based on tone of voice and facial expressions. Relying on electronic communication can result in misunderstandings occurring, that limit a team, preventing the type of team social interactions that can lead to innovation and success [4].

However, other authors have reflected that e-communication may enhance communication as it provides the benefits of being able to review and revise information whereas often face-to-face communication does not [5]. Another extremely important aspect of e-communication is that it may allow work to be conducted synchronously or asynchronously. The ability to use instant messaging for synchronous communication means that dispersed teams do not need to communicate face-to-face [6]. This e-communication may be superior to face-to-face communication as it allows team members to revise and review communication but also benefit from three important characteristics that improve the quality of e-communications: co-preserve, co-temporality, and simultaneity [6].

The rise of social media has resulted in new communication platforms that have been found to have features that could be beneficial in engineering design communication [7]. For example, the availability of emoticons supports the development of interpersonal relationships as team members can add "bandwidth" to communications by conveying emotions [8].

Studies of communication software use by students in global design projects have shown that the most commonly used e-communication tools include *Facebook, Skype, Google Hangouts* and *Whatsapp* [9], for example (see Figure 1 below),
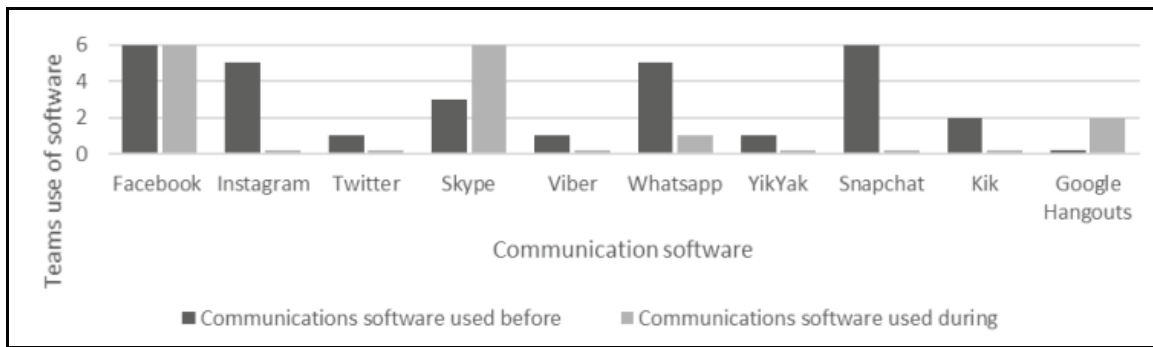
Figure 1. Previous study of student use of communication software before and during a global design project [9]

Brisco *et al.*[9] suggest that students are more likely to use this communication software in a global design project due to their familiarity with it. Unfortunately, these social media platforms may not adequately meet the requirements for the complexity of such a project [7]. Key requirements of such software are the ability to: represent the design; record the engineering context; enable expressive multi-threaded discussion; and, ensure that relevant engineers are notified of the right communication [7].

A solution to this is the use of *Slack*, an increasingly popular team collaboration tool [2]. It has emerged as a hybrid between social media, email, and paid-for group team collaboration tools such as *Microsoft Enterprise*. *Slack* can be grouped with several competitors such as *HipChat* (www.hipchat.com), *Azendoo*, (www.Azendoo.com) and *Bitrix24* (www.Bitrix24.com). These tools offer many benefits over traditional communication tools and mainstream social media for communicating synchronously and asynchronously. For example, they have better structures for multi-threaded discussions, and support file sharing and data control more effectively. *Slack* also has an Enterprise version of its software that is been adopted by large organisations, such as IBM.

This paper highlights the use of *Slack* by students as a novel technology for supporting communication in global design projects.

2   METHODOLOGY

Slack usage was assessed across five student teams participating in an eight week long global design project. This was done via group discussions and analysis of teams' *Slack* sites. Each team was multicultural and consisted of members from the University of Strathclyde, City University of London and the University of Malta. They were tasked with designing an attachment for carry-on luggage to facilitate mobile working.

Qualitative evaluation of *Slack* usage was also conducted via a questionnaire, completed by a total of 16 team members across the five teams. All used *Slack* as their main communication tool. Greatest analysis of *Slack* usage was made in the author's team.

3   RESULTS

Following analysis of the team *Slack* sites and the questionnaire based on students' experiences in a global design project, *Slack*'s strengths and weaknesses are listed and discussed below (see Figure 2 and 3).

3.1 Strengths

Slack's most useful five features were: (1) channels; (2) the ability to share files; (3) the ability to search for old conversations and file names; (4) the availability of a phone app; and (5) the ability to integrate app or bots (artificial intelligence (AI) assistance tools). Each of these features will be assessed to highlight how they supported synchronous and asynchronous communication during project work.
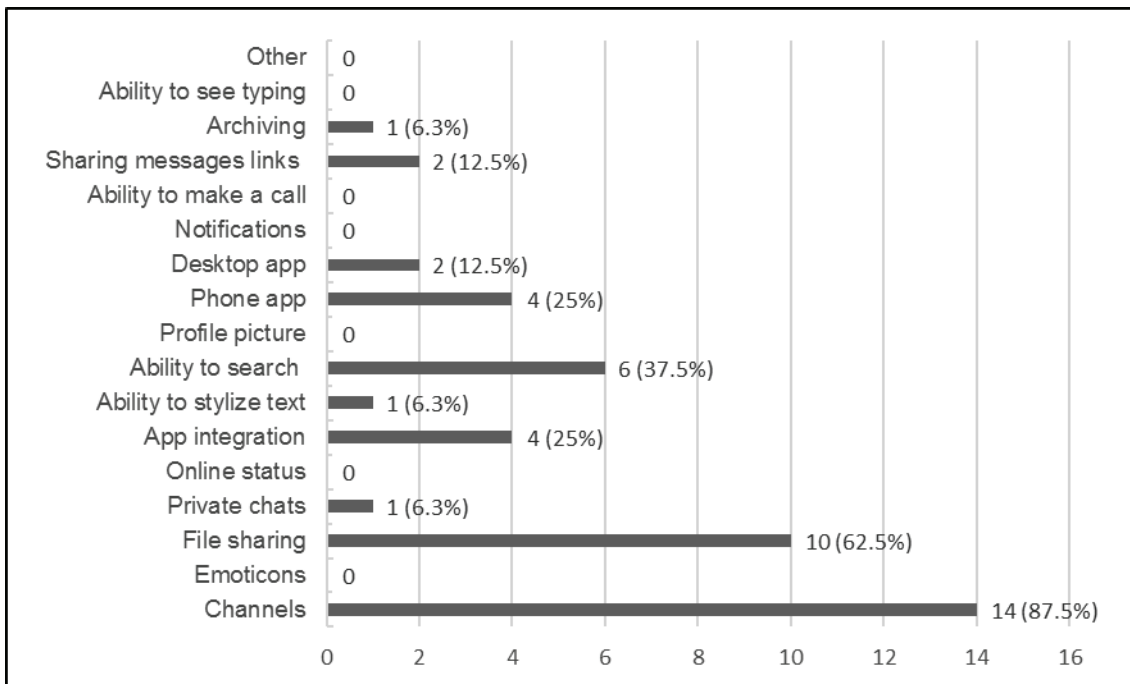
Figure 2. Most useful features of Slack

3.1.1 Channels

The channel feature allows team members to create multiple conversations based on different stages of the project, sub-teams, or activities. 87.5% of team members questioned identified channels as *Slack*'s most useful feature. These channels were found to help in five ways:

Firstly, they allow for concurrent communication that is mainly asynchronous. For example, a team might be discussing scheduling deliverables for the prototyping stage in one channel dedicated to 'Scheduling' while concurrently discussing a specific prototyping task, such as rough prototyping, in another channel; making it easy to track multiple conversations and make multiple decisions in parallel. This allows teams to avoid repetition and confusion in communication. Team members noted that it is the main reason they used *Slack*.

Channels also provide structure to team communication since they can be used for different aspects of the project. They are often based on the project planning stages or sub-team activities. This allows team members to visualize progress of the project and co-ordinate work in sub-groups.

Team members can join or leave the channels which means that they only need to be in those relevant to them or that they want to contribute to. This reduces the amount of unnecessary information that team members need to process and their cognitive load is reduced thereby allowing them to perform better.

The customizable notifications in the channels also help a team member to communicate synchronously, responding quickly, having opted for notifications to be received on their phone, desktop, or email. Notifications of unread messages are also useful for asynchronous communication, allowing a team member to easily catch up on new messages.

Finally, *Slack* affords the archiving of channels once they are no longer relevant to the project, which cleans up the communication work space. This improves both synchronous and asynchronous communication as it allows users to focus on current and relevant information.

3.1.2 File Sharing

62.5% of questionnaire respondents listed file sharing as a beneficial feature of *Slack*. The author's team found that uploading pictures, drawings, and videos, for example the demonstration of a prototype, clarified synchronous online communication. Most teams found uploading *Word* documents assisted with asynchronous communication as completed work could be uploaded quickly for use and continuation by others.

When files are shared on *Facebook*, or emailed, team members can download them and may work with a unique copy of that file on their own device. This can lead to time wastage, loss of data and

miscommunication around different document versions. Integration of *Slack* with *Google Drive* allows for control of document versions by always having a single cloud-based document.

3.1.3 Ability to Search and Retrieve

The ability to search all text and filenames in different *Slack* channels was a feature favoured by 37.5% of respondents. To further support retrieval, 'favourite messages' were starred by individuals. Important messages were 'pinned' in channels to ensure that all team members are aware of them and they could find them easily. Finally, all messages have unique hyperlinks so team members can add context to a conversation without spending time searching for a referred-to message or file.

3.1.4 Phone App

20% of the team members questioned identified the availability of a phone app as an important feature of *Slack*. An app assists with asynchronous and synchronous communication. For example, it allowed team members to respond to urgent messages quickly or when team members were running late for a meeting they could quickly update others. Another example where it was useful was for sharing videos and pictures taken of sketches and prototypes during online chats or *Skype* calls.

3.1.5 App/Bot Integration

Besides Google Drive, *Slack* can integrate with many external apps or "bots". For example, one team used *Meekan*, the scheduling tool, which links all team members' calendars to *Slack* and supporting scheduling of meetings.

The author's team found that this and other apps have the potential to reduce the need for synchronous communication in order to clarify issues, and allowed more decisions to be made asynchronously, thus reducing bottlenecks in communication.

3.2 Weaknesses

A high percentage of the members (69%), questioned from the five teams, reported that they would use *Slack* instead of other social media in future projects. This is significant considering that most team members had not used *Slack* previously and were initially sceptical about its use as it was not a software tool that was suggested by course educators.

However, team members did point out that *Slack* could still be improved. The diagram below shows some of the features that team members in the global design project thought would improve *Slack*.
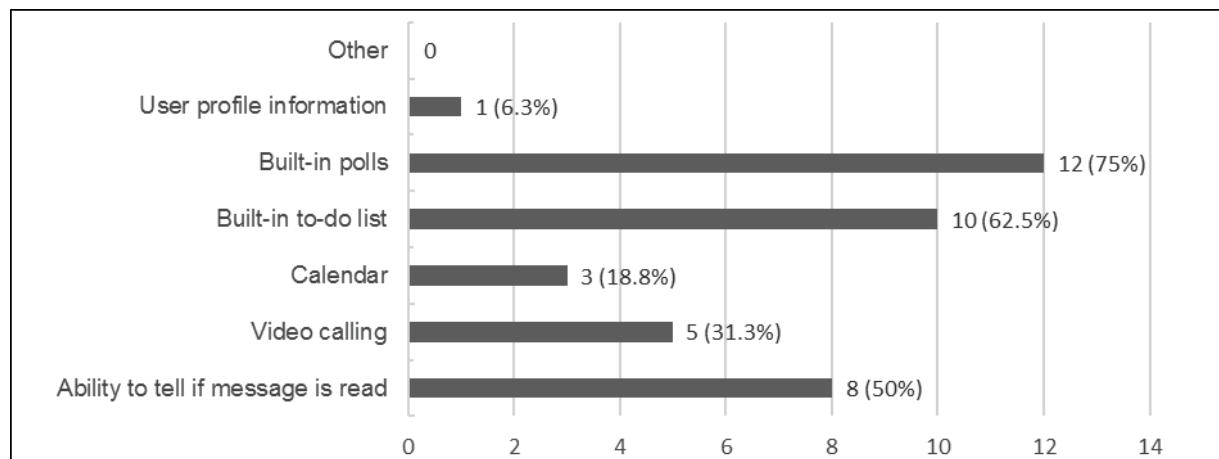

Figure 3. Missing features on Slack

3.2.1 Built-In Polls

Polls can be an extremely useful way of making group decisions asynchronously. *Slack* allows for the connection to external polling sites, via App integration, however, the author's team considered using *Doodle* but were reluctant to adopt yet another app. 75% of team members questioned agreed that a feature in *Slack*, similar to *Facebook* page polls, would have been beneficial.

3.2.2 Built-in To-Do List

Two important aspects of managing project progress is monitoring which tasks need to be performed and keeping track of the work done on tasks. To-do lists assist asynchronous work since meetings are not required to update team members on progress. *Slack*, social media and email do not have any efficient and simple way of highlighting tasks-to-be-done. The author's team noted action items in meeting minutes but they did not refer to them frequently as they weren't in an easy-to-find location. 62.5% of team members questioned, thought it would be a valuable addition to *Slack*.

3.2.3 Ability to Tell If a Message Is Read

Facebook, Whatsapp and some other social media have indicators next to messages that allow a message sender to see if a team member has read their message. Once a message has been 'seen' there is an unwritten time limit that is deemed to be socially acceptable for the target of a message to respond. Whether this peer pressure is healthy for team cooperation is debatable but 50% of questionnaire respondents said they missed it on *Slack*.

3.2.4 Video Calling

31% of poll respondents listed 'video calling' as a feature that was lacking in *Slack*. The use of an external app such as Skype was required. Experience found, the transfer from communicating in *Slack* to communicating in a video call was not seamless and resulted in wasted time as students tried to simultaneously connect with multiple tools such *Skype* and *Facebook* in order to establish a video connection.

4   RECOMMENDATIONS

From our experience of using *Slack* in global design projects, students and educators are to be encouraged to use it as a communication tool. Through experience and discussion several key recommendations have been drawn up to benefit from its use:

1.	Educators should recommend *Slack,* or similar tools for communication, as students often require endorsement before attempting to use new software.
2.	Plan the team-use of *Slack*:
(i)	Ensure all team members agree on the use of the technology.
(ii)	Increase the ease and frequency of team communication by ensuring all team members have installed the phone app and if possible the desktop app too.
(iii)	Ensure that team members are aware of important communication by educating team members about the use of notifications.
(iv)	Improve the effectiveness of communication by educating team members about *Slack's* features that facilitate search and retrieval of information;
(v)	Assign a software champion to establish the best apps to support the different activities in the project. The champion must educate other team members on their use
3.	Develop a team structure and project plan and use *Slack*'s channels to represent and co-ordinate this virtually.
4.	Avoid repetition and confusion in communication by creating channels that have a clear purpose that is understood by the team.
5.	Encourage concurrent execution of work via the use of channels that allow sub-teams to work in parallel on different aspects of the project.
6.	Reduce team members' cognitive load by only inviting them to channels that are relevant to them.
7.	Archive channels that are no longer relevant to help the team focus on fresh information and move the project along.
8.	Encourage team members to upload files to complement and clarify communication.
9.	Avoid loss of data by integrating Google Drive into *Slack* to manage file sharing.
10.	Teams must identify *Slack's* weaknesses and create strategies for dealing with shortcomings of the software

5   CONCLUSIONS

Exposure to *Slack* is highly beneficial to students who may only have prior experience of using social media and email for communication. It can prepare students for working in a global economy where design projects are supported by a combination of synchronous and asynchronous communication.

Small businesses will increasingly use *Slack* or similar free software to do this. Larger companies will look to use enterprise versions.

While social media is easy and convenient to use, *Slack* has similar benefits with the added ability to support multi-channel communication; enable the communication required for concurrent engineering; aid effective and efficient communication; and facilitate the collection of project knowledge and data in a single, easy-to-search location.

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