

STUDENT PERSPECTIVES ON COMMUNICATION: A CASE STUDY ON DIFFERENT METHODS OF COMMUNICATION USED BY ENGINEERING STUDENTS

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EXTENDED ABSTRACT

The purpose of this paper is to provide insight into the different communication methods used by engineering students in order to improve engineering teaching and learning. As part of a second year Project Management module, engineering students participated in collaborative group work. This involved 320 engineering students, organised into 54 groups, competing in a simulated business environment. As part of their final group reports, students were asked to describe and assess the methods of communication used within their group and with members of staff. The student responses identify how online forms of communication were used alongside more traditional forms. The responses also highlighted the perceived advantages and disadvantages of different communication methods and offered valuable insights into student practice within a collaborative learning environment. This paper investigates how these findings can be used to improve teaching techniques within engineering and particularly in supporting large numbers of students in collaborative group projects.

There are two sections of analysis within this paper. The first investigates communication between students engaged in collaborative work; the second considers communication between student groups and teaching staff. Each section will present the methods used and the perceived advantages and disadvantages of each.

The case study results indicate that students utilise multiple means of communication and develop the skill of being able to assess the advantages and disadvantages of specific methods. They can adapt their communication to suit the different methods and will make use of one method to supplement the perceived deficiencies of another. The paper also describes how student perception of communication can be used to inform learning techniques and practices.

KEYWORDS

Engineering Education, Collaborative Learning, Student Communication, Multi-Modal Communication

1. INTRODUCTION

As part of a second year University of Manchester Project Management unit, engineering students participated in collaborative group work. This involved 320 engineering students, organized into 54 groups, competing in a simulated business environment. Students were all full-time, based at the University and in their second year of undergraduate studies. Students were organized into multidisciplinary groups of 5-6 students. Each group was asked to nominate a leader who would be the focus of correspondence with teaching staff. The business simulation used was April Training's 'Executive' simulation of the car industry [1]. Using this, students gained experience in developing a business plan, making investment decisions and competing with other teams in a volatile marketplace. Assessed coursework consisted of a business plan, a final report and a poster presentation.

The Learning Outcomes of this unit included:

1. to appreciate the wider multidisciplinary engineering context and its underlying principles;
2. to communicate information accurately and effectively;
3. to make effective use of IT facilities for information management and retrieval.

As part of their final group reports, students were asked to describe and assess the methods of communication used within their group and with members of teaching staff. The student responses identify how different forms of communication are used and indicated an awareness and achievement of the Learning Outcomes of the unit.

1.1 Collaborative Learning

Teaching and learning methods within engineering education have had to adapt to increasing class sizes and student populations. The use of blended learning (as recommended by the Higher Education Funding Council for England [2]) alongside the introduction of e-learning platforms has been crucial in forming a response [3]. Blended learning not only includes the mixing of different learning techniques, such as lecturing and collaborative group work, but also the incorporation of different web-based technologies into instruction [4, 5, 6].

Collaborative learning involves a 'strong commitment to joint aims' and 'mutual assistance' with 'little or no direction from someone in a position of power' [6]. Although typically done in small groups, this approach can effectively be deployed within large classes, as seen in this case study. In collaborative learning, both the student and the teacher take on more flexible roles. Students are able to take more responsibility for interpreting tasks and in developing problem solving skills [7]. Teaching staff take a less directive role and become more 'designers and managers' who facilitate learning [8]. Guidelines for good practice in undergraduate education indicate that 'good learning, like good work, is collaborative and social, not competitive and isolated' [9]. Collaborative group work also allows students to develop skills needed in the work place [10].

1.2 Multi-Modal communication

Students born after 1980 have been termed the 'net generation', for whom online interactions are a natural feature of both their social and learning environment [11]. Online activity is commonly used by students in research, peer-assessment, discussion and information gathering. Web-based platforms form part of a wider 'multi-modal' set of communication activities that integrate both online and offline forms of communication in education [3]. The integration of web-based learning platforms within the educational environment allows learning to become more 'student oriented' while also reducing the

time expended by the teacher [12]. This results in increased student responsibility for learning. Although studies have highlighted the benefits of this approach [12], face-to-face contact between students and teaching staff remains a priority among students [13, 14].

The increased variety of communication methods in the learning environment has led to the need for additional writing skills among students [14]. Use of emails, letters or short messaging service (SMS) require decisions about which method to use and the ability to communicate in a manner appropriate to the medium. Specific methods of communication have also been identified as having multiple functions. For example, Bangert [13] has identified student use of email for distributing announcements, clarifying assignments, providing individual explanations and addressing specific enquiries. Granić et al [17] have identified multiple purposes within e-learning platforms (such as Blackboard used in this case study) including reading forum messages, receiving direct feedback on work and receiving another perspective to a problem.

2. ANALYSIS OF COMMUNICATION METHODS

The final reports submitted by groups summarised their key learning points from the business simulation activity. This included a section where groups considered the effectiveness of their communication outside of group meetings and with teaching staff. These reports were analysed and the conclusions are presented in this paper. The communication methods used and the perceived advantages and disadvantages of each are presented.

2.1 Assessing Student-Student Communication.

Figure 1 presents a breakdown of the number of methods used by the 54 project groups to communicate outside of face-to-face meetings. Only five groups reported using a single method of communication (7%). 32 groups (51%) stated that they used two methods of communication – email and telephone. 16 groups (40%) stated that they used three methods, in most cases supplementing email and telephone communication with social networking sites. Only one group used four methods of communication. These results show clearly that students use multiple means of communication and supports Limniou and Smith's claim that student interaction is 'multi-modal' [3].

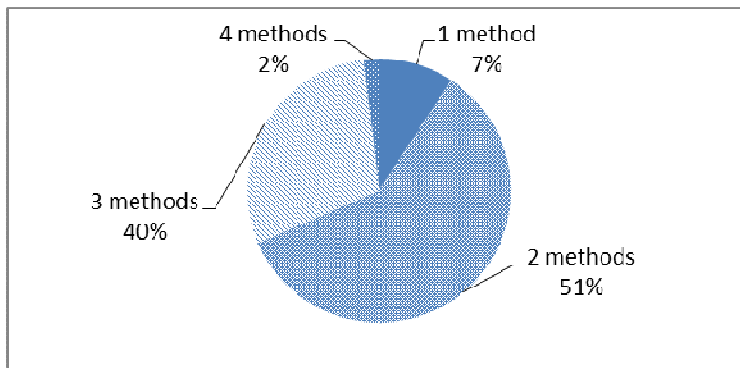


Figure 1: Summary of Communication methods used by student groups

As Figure 2 shows, a total of five different methods were used by students, although no single group used all five together. 53 groups (98%) reported using email and 50 groups (92%) used the telephone to communicate outside of meetings. 13 groups (24%) communicated on social network sites (SNS), two groups (4%) used instant messaging

services (IMS) and one group used the web-based conference calling service, Skype. The following analysis will examine the most popular two methods individually and the remaining methods together.

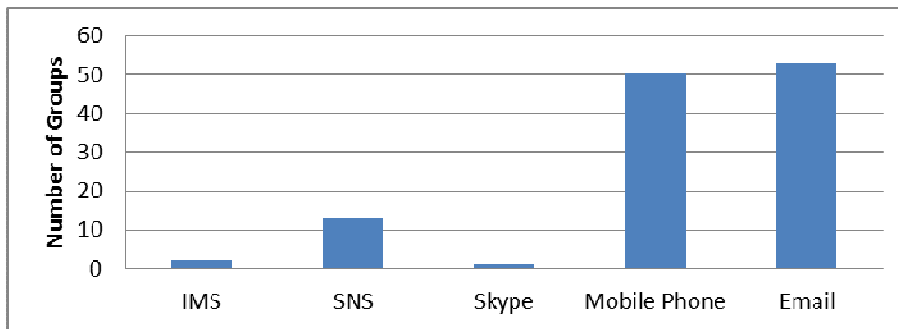


Figure 2: Summary of specific communication methods used within the student groups

2.1.4 Email

Email was used by almost all of the groups to communicate and was reported as being used to:

- arrange meetings;
- distribute documents and information to all group members, including absentees;
- distribute document drafts and receive feedback and suggestions;
- assign tasks to group members;
- circulate ideas and thoughts to all group members;

In summary, email was used for notification and information distribution. It was also identified as a medium through which all group members could communicate collectively, allowing documents to be produced. This supported the collaborative nature of the project work. However, email was also subject to the following criticisms:

- not all group members read emails regularly;
- it can take too long to receive replies or answers;
- it is not always accessible as it requires having access to the internet.

To be effective as a method of communication, email is reliant on group members regularly reading and responding to their email, with some groups indicating this was not always the case. One group also indicated that their use of email was not as effective as it could have been because members failed to use the 'reply all' function, leaving the majority of the group out of any continuing discussion.

2.1.5 Mobile Phones

Two distinct functions are included in the analysis of the mobile phone communication: voice calls and SMS. The following points summarise the functions and advantages identified by students about the use of the mobile phones:

- SMS used to notify group members of meetings and deadlines;
- SMS used to inform group of project results;
- SMS more likely to be read than emails;
- Voice calls were made to discuss changes and request information.

Although the mobile phone was a popular medium, the students also identified some disadvantages to its use:

- it does not allow affordable communication as a group; restricted to one-to-one conversations;
- difficult to contact people if phone was switched off or battery flat;
- use of phone has significant costs.

In summary, students used mobile phones as a quick and effective method of information distribution and notification. The restriction to one-to-one communication and short messages meant it was not suitable for the collective document distribution and production associated with email. However, as SMS and calls were more likely to be answered than email, the use of the telephone was able to compensate for the deficiencies associated with email. One group stated: "*emails were sent out by the group leader. These were then followed up by SMS alerting members to check their inboxes*".

2.1.6 Other Methods in Student-Student Communication.

This section briefly examines the remaining methods identified by students including Social Networking Sites (SNS), Instant Messaging Services (IMS) and Skype. Boyd and Ellison describe the functions of an SNS as holding semi-public profiles and articulated lists of connected users [16]. Other useful functions include: the creation of groups, IMS, and the use of email. SNS, exemplified by Facebook, are mainly used as social platforms rather than being associated with education. However, Facebook did present some groups with a space for undertaking group work. As one group stated '*everyone has a Facebook profile*'. Facebook use ranged from sending emails to group members identified through their Facebook profile, to the use of Facebook's IMS and the formation of their own 'Facebook group' to carry out project work. The diverse facilities within Facebook meant documents could be exchanged, important messages could be sent quickly and group discussion could take place. It also indicates that as the groups formed, members were likely to include each other in their online social network. One group identified the perceived lack of privacy in Facebook as an important issue, making them reticent to discuss project work on the site. Among the other methods, IMS and Skype allowed group discussion in a quick and easy format, although their use was limited as other methods also fulfilled these functions.

2.2 Student- Staff Communication Methods.

During collaborative group work, teaching staff take on the role of a facilitator and manager. Blackboard is a web-based e-learning platform used to supplement and support courses taught at the University of Manchester and includes content distribution and discussion board facilities. Information on the business simulation and the organization of teams was provided in lectures and supplemented by downloadable material in Blackboard. The main reasons for students to contact staff therefore centre on clarifying procedures, assessment issues and providing advice on group relations in the collaborative process.

Figure 4 indicates that the number of methods used to communicate with staff were significantly less than those used between students. Only 43 groups commented on communication with staff. Of these, five groups (12%) said that they used three methods of communication (email, Blackboard and Face-to-Face). 17 groups (40%) stated that they used two methods of communication. This was closely followed by 14 groups (35%) who stated they used only one method to communicate. Significantly, 6 groups (14%) said they did not actively communicate with teaching staff as they had all the required information already and did not have any need to communicate. There was a degree of under-reporting noted, with some groups who had face to face meetings and lengthy email correspondence failing to acknowledge this in their reports.

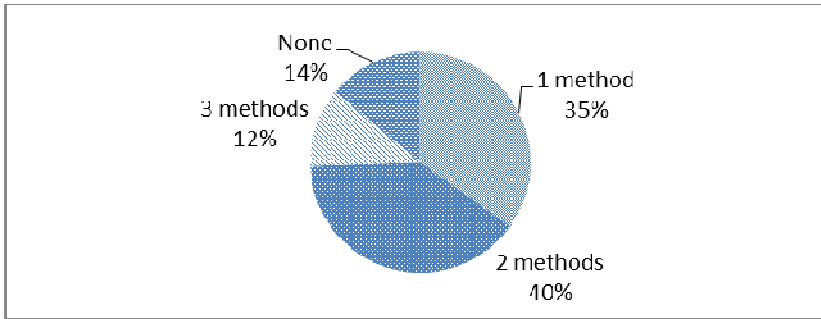


Figure 4: Summary of Communication methods used between groups and teaching staff

Four different communication methods were used to communicate with teaching staff (as shown in Figure 5). Email was the most popular method, 29 groups (46%) stated they used it. 24 groups (44%) stated they used Blackboard discussions and 14 groups (24%) also stated that they had face-to-face contact. Only two groups stated that they used the telephone to call the teaching staff. Significantly, the student groups also provided comments also on communication with the business simulation provider who took technical queries by email and telephone. This highlights the need for an integrated response to communication with the University staff and business simulation provider responding to student queries, keeping each other informed and referring issues appropriately.

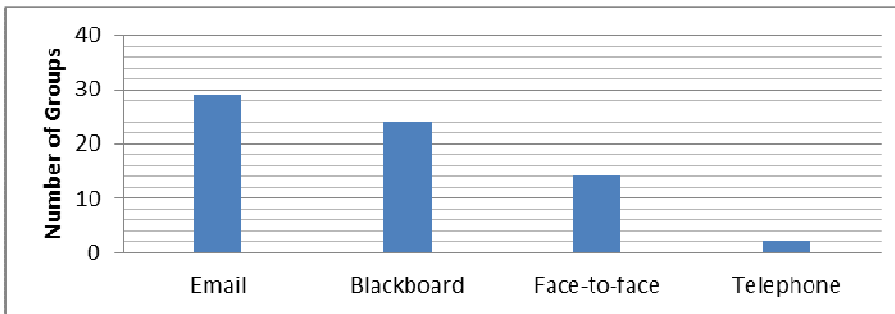


Figure 5: Summary of Communication methods used between groups and teaching staff

Generally, the students expressed satisfaction with the communication; comments such as 'approachable', 'always available to answer questions' and 'friendly' were used to describe the teaching staff involved in the course. Statements about electronic communication with the teaching staff and the business simulation provider were also appreciative. Comments on the responses to queries included: 'prompt and useful', 'very helpful', 'efficient' and 'quick'. All queries were responded to within a few hours of receipt and this was clearly appreciated by the students.

This responsiveness demands that teaching staff monitor communication and respond to students using multiple methods. Information exchange is no longer confined to the classroom. The tutor also needs to be able to respond to queries by email, in the Blackboard e-learning system, face to face and occasionally over the telephone. It also highlights the importance of working with external training providers as an integrated team to respond effectively to student queries.

2.3 Different Communication methods with Teaching Staff

Email was also a popular method in student-staff communication. In the final reports, email was described as a quick and useful means for contacting staff when technical, procedural, group management and assessment issues needed to be raised. Compared to the discussion points, email queries tended to be more involved and sometimes contain confidential information about individual student performance. When relevant to a wider audience, teaching staff summarized responses to email queries in Blackboard discussion points. Two students made the transition from posting questions in emails to (subsequently) posting questions on Blackboard. This showed that they were learning about different ways to communicate with teaching staff.

Blackboard was identified as another very popular method for communication with teaching staff, with the discussion board the most popular feature used. In summary, the following benefits and uses were highlighted by students using Blackboard:

- quick and efficient communication with staff
- browse message threads as a source of information

63 separate discussion points regarding the business simulation appeared on Blackboard. In total, these were viewed 4359 times. This is an average of 69 views per item; the most popular item had 259 views. Only 21 students (6.5%) posed questions on the discussion board. These numbers indicate that Blackboard was primarily used to 'browse' for information with the majority of students taking a passive role.

Discussion items posted by students were typically short (1-2 sentence) requests for information. Most 'discussions' were limited to a student query and a response from teaching staff. It was only the final reports submitted by the groups that acknowledged the majority of groups had viewed the discussions on blackboard and found them helpful. As one group identified *'the points of discussion were the same issues that were raised amongst most of the other groups'*. This highlights a disadvantage of this method of communication since it was not clear to the teaching staff that the responses were reaching a wider audience. It also indicates that students primarily viewed Blackboard as a repository and the discussion points as a means of requesting further information.

Face to face meetings were sometimes arranged as a result of the email queries. The other opportunity for these was ad hoc enquiries after the lecture period. Students placed high value on face-to-face contact with staff and felt this was an effective means to address queries about the business simulation. There were comments in the reports indicating that students desired more face-to-face contact time and felt this would help to avoid problems. The requirements from this contact focused on the ability to ask specific questions and receive a direct response from staff, whether after a lecture, in an office meeting or tutorial.

3. DISCUSSION

In their Group Learning Reviews, each group was asked to identify three learning points resulting from the business simulation. The top three areas of learning for the students were Communication Skills (34 groups), the ability to work in a Team (32 groups) and Time Management /Planning (31 groups). The category 'Teamwork' included statements regarding group management, task allocation and the importance of discussion and compromise, while 'Communication' included statements on the ability to listen. The Learning Points indicate that both 'teamwork' and 'communication' are seen to be valuable skills and that students make a strong connection between the skills developed in group work and those needed in the professional environment. This recognition

broadly supports the aims of higher education and collaborative work identified by various authors [8, 9]. It also indicates a connection between the students' learning points and the module learning outcome 'to appreciate the wider multi-disciplinary context of engineering'. Students recognised that interpersonal skills and the ability to work with colleagues and clients central to the future workplace.

Multi-modal communication has been defined as the integration of multiple offline and online methods of communication. This case study highlighted that engineering students used multi-modal communication and were able to integrate different methods according to the perceived advantages and disadvantages of each. Multi-modal communication can therefore be considered a skill that requires assessing and adopting appropriate methods of communication. As one group stated, this skill developed during the simulation: *'At the beginning of the simulation the team commented by email [...] but as the simulation went on, the team started texting each other more and taking on the phone, which increased the understanding between each other'*. The analysis also indicated that while students deployed multiple methods, they also used a single medium for multiple purposes as was the case with email. This expands the definition of multi-modal communication to not only include multiple methods of offline and online communication, but also multi-functional uses of a single method.

The analysis of comments regarding student-teaching staff communication indicated that students valued speed of response and receiving answers to very specific questions. Concerning Blackboard, students not only regarded directly posing questions to staff as effective communication, but also the ability to browse existing discussions. The implication is that active use of the discussion boards by teaching staff allows communication with an increased number of students. This minimises the need for advice to be repeated to individuals or groups, while still being recognised as effective by students.

In the case study presented, email was revealed as the most common means of communication within the student group and with the University staff. Use of email allowed a co-ordinated response to queries by the external training provider and the University teaching staff. Regular communication between all those involved in the teaching was helpful to resolve any issues and to plan further work.

4. CONCLUSIONS

The analysis of communication methods used by students indicated their ability to assess the advantages and disadvantages of each method and to integrate them to support their learning. This indicates achievement of the learning outcomes 'to communicate information accurately and effectively' and to 'make effective use of IT facilities for information management and retrieval'. The analysis also indicated that that students not only made use of IT facilities to retrieve and manage information, but also to edit and produce documents.

Students engage in multi-modal communication and are able to adapt and integrate different methods of communication to support collaborative group work. This study suggests that multi-modal communication is a skill that is actively developed in the collaborative processes and that it is possible to expand the definition to not only include multiple methods of offline and online communication, but also multiple functions within a single medium.

This case study also suggests that students held a particularly defined view of effective communication with teaching staff, which centred on receiving answers to direct

questions concerning technical, assessment and group management issues. Students considered both face-to-face contact and the use of Blackboard as effective. There was also a requirement for more tutorial contact outside of lecture periods. This highlights the position of the teacher as facilitator and manager within collaborative learning. It also demonstrates the need to balance face-to-face contact with the use of e-learning platforms. The extent of communication between student groups and staff emphasise the need for good communication skills on the part of teaching staff and a flexible approach to addressing student queries. Queries can also be summarized and used as teaching points in lecture periods. Involvement of external organisations to provide specialist business simulations can be very beneficial in supporting collaborative learning. In this case, the University staff and the training provider need to be able to work together to provide information an integrated and efficient response to student queries.

The paper describes the integrated use of multiple communication methods to support collaborative learning in engineering. Effective multi-modal communication can provide a means to address students' desire for increased face-to-face contact within the pressures and time-limitations of teaching large classes. Student support in this environment requires an integrated and collaborative response from University staff and external training providers.

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