The Current use of Technological Communication in Industrial Engineering Group Work

Denise H. Bauer
Gül E. Kremer
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Denise H. Bauer
Leonhard Center for the Enhancement of Engineering Education
Pennsylvania State University, University Park, PA 16802, USA

Gül E. Okudan
School of Engineering Design
Pennsylvania State University, University Park, PA 16802, USA

Abstract

Traditional face-to-face collaboration for localized group work may be reshaped by the widespread use of technological communication as college students are arriving to school already familiar with communication technology. Students were asked about what type of technological communication they currently use, if they have any experience with remote group work, and their perceptions on incorporating technology into group work. Classes that currently include group work will also be monitored. The information from the students and class observations will then be used to develop ways of implementing technological communication into the classroom.

Keywords
Technology use in group work, instant messaging, communication and engineering education

1. Introduction

Group work is an important part of the engineering curriculum as employers are stressing the need for future engineers to be able to work collaboratively with those both in and out of their preferred field. The use of technology in the classroom is also becoming a necessity as most students today are immersed in technology since birth, very comfortable with technology, and may become impatient with those that lack technological sophistication [1]. Taylor [1] believes higher education must become aware of these technological issues in order to continue to engage the student adequately. Globalization is also forcing engineers to connect to all parts of the World and the use of technological communication will be a necessity in the workplace [2], perhaps it already is.

Engineers must become World-Class Engineers that are able to work with a wide variety of cultures in a collaborative setting from their own desk as the World is "flattening" through the affects of globalization and technology [3]. The need for students to be prepared to work collaboratively through technology brings about the question on just how does technology, such as email, Instant messaging, and text messaging, affect the group dynamic?

The traditional face-to-face collaboration for localized group work may be reshaped by the widespread use of technological communication [4], such as instant messaging (IM). New college students are arriving to school already familiar with communication technology as a Pew Internet and American Life Project study found that in 2004 62% of the internet users between the ages of eighteen and twenty-seven had used IM [5]. This number will only continue to rise as the technology becomes more and more popular.

A trend towards the use of IM over face-to-face meetings is already taking place in the business world. In addition to personal use, ten percent of the IM users in 2004 were business people [6] and the Radicati Group expected half the IM users to be business users by 2006 [5]. The use of IM in the business world leads one to believe that students should be exposed to IM as a tool for group collaboration. However, inclusion of IM as a tool for group collaboration brings about other concerns that should be addressed.
One concern with the use of IM for group work is how this technology will affect the traditional group dynamic. If the students use IM heavily, will the face-to-face meetings cease to exist? If this is the case, will it defeat the purpose of exposing engineering students to the experience of group work that employers say is a necessary skill?

Another concern is how different students will react to and feel about the use of the technology. Gender and learning styles are two differences that may play a key role in how students feel about using technology as a collaboration tool, and thus should be addressed. Gunawardena and Bowerie [7] found that student satisfaction varied according to the preferred learning style when using computer-mediated classes. Chou and Wang [8] studied learning during homepage design training and found that the learning style was a significant factor in the scores for different tasks. These results are enough to draw concern that if technological collaboration tools are a necessity for tomorrow's engineers, these differences should be addressed to determine how all students could benefit.

The general goal of the research presented in this paper, is to assess how technology affects the traditional interactions of localized group work in Industrial Engineering classes. The more specific goals are to understand how students with different learning style preferences feel about the use of technology for group work and to determine if there is a difference between genders. These goals are addressed through four research questions: (1) What are the current technologies available for collaboration during group work and which of these technologies do students choose to use? (2) Does the use of technology take away from the traditional face-to-face group work or does it enhance the experience? (3) Is there a difference among the learning styles on the use of technology and group work? Does it affect the learning of those individuals? (4) Is there a difference based on gender on the use of technology and group work? If there is a difference, does it affect the learning of those individuals?

The research questions, indicated above, require a comprehensive multi-method data collection. The data collection and related results will be presented in a series of publications. This paper focuses only on Industrial Engineering students and their use of communication technology in course group work. Plans for data collection and related instruments for the comprehensive study are first summarized below. Then, details on the completed pilot study in the Department of Industrial and Manufacturing Engineering are provided.

2. Methodology
Students will be asked, through surveys and focus groups, what type of technological communication, if any, they currently use to complete group work, if they have had any experience with remote group work, and their perceptions on incorporating group work through technology into the engineering curriculum. This data will indicate the level of technology already in use by the students and if they feel it would be beneficial to their education to include group communication through technology in the curriculum. Comparisons will be made based on the students’ year in school, gender, and learning style to determine if differences between these groups needs to be addressed when implementing technological communication into in-class group work. To compare the differences in the use of technological communication during group work, the behavior and class outcomes from students in two classes that are taught both on-campus during the regular school year and online during the summer session will also be examined after the summer session is complete.

As the pilot data collection, a survey on the use of communication technology was distributed to a group of 21 Industrial Engineering students. This survey included questions on the frequency of technological communication usage, such as instant messaging and text messaging, in both their social and school lives. The students were also asked which technology methods they use during group work and which they believe would be most important, effective, and efficient. Students were also asked their opinion on including communication technology in the course curriculum and how best it should be implemented. This survey later will be distributed to all students in the Industrial Engineering Department.

The pilot survey results were examined for the use of communication technology among all subjects as well as for differences between gender and year in school to determine if there may be gaps in the use of technology among these groups.

3. Results
Twenty-one Industrial Engineering students were included in the study pilot group. There were 14 males and seven females in the group that consisted of one first year student, 13 second years, two third years, and five fourth year
students. All but one of the students (95%) use instant messaging to communicate with their friends in a social setting while all but three (86%) use instant messaging as a communication tool for class work. The most common instant messaging programs for both settings are American Online Instant Messaging (AIM) and Facebook. For those students that IM for social communication, 90% use AIM and 85% use Facebook while 100% of the students that IM for group communication use AIM and 61% use Facebook. The other listed programs used are Microsoft’s Windows Live Messenger and MySpace.

When comparing the time spent using instant messaging in these settings, students spend an average of three hours per week communicating with their friends while they spend an average of two hours per week instant messaging for group work. The greatest difference between genders can be found in the average time using IM in a social setting where the females reported an average of almost three times as many hours per week than the males. The females also replied that they spend half as much time using IM for class than for communicating with friends. When the students are grouped into school year (2nd and 3rd years together – first year in Industrial Engineering; 4th and 5th years together – seniors in Industrial Engineering), there are no statistical differences between the groups, but all groups averaged a little over a half hour less spent using IM in a class setting than in a social setting.

The students were also asked what types of communication they use when conducting group work at school. The choices were face-to-face meetings, email, instant messaging, text messaging, ANGEL (course management program at Penn State), and phone (voice). Figure 1 shows the average frequency of usage for each method for each gender while the average for school year is shown in Figure 2. Face-to-face meetings and email are the most frequently used methods of communication for all groups while IM, text messaging, and ANGEL are the least used methods. Once again, it can be seen that females tend to use IM than the males. From Figure 4 it can also be seen that the 4th and 5th year students appear to use communication technology more than the 2nd and 3rd year students do.

For each of the five technological communication methods, the students were asked how important it is to learn how to use each method for group work communication. Students ranked the methods on a scale from zero to four, with zero being not important at all and four being extremely important, and the results can be seen in Figures 3 and 4. The students feel that it is most important to learn how to use email for group communication while instant messaging and text messaging were believed to be the least important. The largest differences in responses between genders can be found for IM and ANGEL where females feel it is more important. When examining the results for school year, the 4th and 5th year students feel it is more important than the 2nd and 3rd years to learn to use the phone for communication but think it is less important to learn to use ANGEL.

Students were also asked how effective (Figures 5 and 6) and efficient (Figures 7 and 8) they thought each method is for group work communication, with a response of zero relating to not effective or efficient at all and a response of four relating to extremely effective or efficient. Similar results were seen for both questions and the results mirror the responses from the question on how important it is to learn to use each method. The only difference that may
Bauer and Okudan have a significance is for the both the effectiveness and efficiency of ANGEL among genders. Females feel ANGEL could be more effective and efficient in group communication than the males do.

Figure 2: Average use of group communication per project: school year

Figure 3: Average importance of learning to use different technologies for group work communication: gender

Figure 4: Average importance of learning to use different technologies for group work communication: school year
Figure 5: Average effectiveness of communication technology for group work: gender

Figure 6: Average effectiveness of communication technology for group work: school year

Figure 7: Average efficiency of communication technology for group work: gender
4. Discussion

The responses from the pilot group show that, while all the students have face-to-face group meetings, they are also using technological methods to communicate. However, while Industrial Engineering students use technological communication on a regular basis, they do not feel all methods are conducive to successful group communication. In the case of instant messaging, students appear to use the method, but feel it is one of the methods least likely to be beneficial for group work communication. From this small pilot study, there does not appear to be an indication of gender bias, as females tend to use IM and other forms of technology to communicate more than the males, but rate the effectiveness and efficiency of most of these lower than the males.

When asked about the impact of technology on student learning, the students feel technological communication will improve overall group work, but can never replace face-to-face meetings. The consensus was that the main advantage of the use of technology is that it allows information to be shared more easily and quickly. Some students also believed that it would be easier for the group to organize their thoughts and ideas with a record of each member’s exchange. Other students felt that using technological communication for group work would improve the overall communication skills of each student and prepare them for their future in the workforce. However, the students did indicate that the group members must be on the same page and programs relevant to industry should be implemented into the curriculum in order for the experience to be beneficial. Students also believe an important part of teaching students how to use communication technology properly is to include differences between countries and cultures. They feel this is more important than learning the actual process of using the tools.

Students that participated in remote groups for an online Industrial Engineering class were asked similar questions as the pilot group. These students indicated that the most common form of technological communication used during group work is email and the phone, as found with the pilot group. Instant messaging was also used with most students using AIM. The students in the online class indicated that conducting group meetings through online methods or phone conversations was easier than face-to-face meetings when trying to schedule meetings with busy work schedules. It also allowed members to be in different locations while still participating in the group process.

Future data on actual group interactions for on-campus and online classes should allow a better understanding of how technology affects the group dynamic in Industrial Engineering classes. The students’ learning styles will also be explored in the class studies to determine if the usage and acceptance of technological communication differs among the styles and should be addressed when incorporating technology into group work.

5. Conclusions

The pilot study indicates that Industrial Engineering students are currently using technological communication for group work, but only as a supplemental tool. Globalization is forcing many engineers to work with others in other cities, states, and countries where face-to-face meetings may not always be viable, thus learning to communicate effectively through technology will be an essential skill for the future engineer.
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References
