2006-1450: AIM FOR BETTER STUDENT LEARNING: BEST PRACTICES FOR USING INSTANT MESSAGING AND LIVE VIDEO TO FACILITATE INSTRUCTOR-STUDENT COMMUNICATION

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AIM for Better Student Learning:
Best Practices for Using Instant Messaging and Live Video to Facilitate Instructor-Student Communication

Abstract

As bandwidth continues to expand, and wireless connections propagate to the point of becoming ubiquitous, the nature of communication, both formal and informal, is undergoing a real transformation. This transformation is reflected within the student bodies of colleges across the nation as text messaging, live personal video and internet voice communication become more evolved technically and entrenched in the psyche of our students. Student comfort levels with instant messaging, documented by these authors in previous papers, is only one sign of the coming wave of communication tools and attitudes which will truly blur the line between actually there and virtually there.

In this paper, the authors document their experiences with instant messaging, video-based one-on-one student instruction and internet telephony. Further, best practices are recommended for the use of these technologies in the engineering classroom. In general, the authors have found that students are extremely comfortable with these technologies, that using these technologies has become radically easier in just the last 18 months, and that student learning and excitement can be greatly enhanced through the judicious use of chat, one-on-one video conferencing and internet telephony. These have also allowed us to expand the reach of instructors at USMA, with one-on-one teaching across great distances becoming simple and efficient.

Introduction

A student walks into a computer lab where the plotter is located, logs into the computer, and downloads a simple piece of free software. She then pulls an inexpensive webcam out of her backpack and plugs it into the machine. She clicks on the icon for her design team member who is working the dead afternoon shift at the student union and is on wirelessly. They chat briefly, with live video, about the objectives for that evening's design, exchanging ideas verbally, nonverbally and with sketches. They shut down the video but not the text chat window and work on two aspects of the project, text chatting when needed and otherwise ignoring that the chat function is even open. A snag occurs and they are not sure how to proceed. Checking, they see that the instructor is logged in (he is not always on, but they are in luck) and they ask a quick question. Using video, the professor explains to both students at the same time what is what, and the students drive on with the project, validated, happy and highly productive.

This is not science fiction, but current best practice for collaboration. As Robert Farmer wrote in EDUCASE, "IM is a relatively simple form of communication. It is also—by its very nature—a collaborative communications tool."[3] This collaborative nature makes IM ideal for educational and learning environments. Farmer also states that collaborative communications tools create "a more engaging learning environment for students, most of whom have already adopted the readily available IM tool and use it prolifically."[3] Given its collaborative nature and prominent

use among students, it is clearly part of our job as educators to explore methods such as IM, internet telephony and video-conferencing and guide ourselves and our students towards the most effective methods of communicating and collaborating.

As bandwidth continues to expand, and wireless connections propagate to the point of becoming ubiquitous, the nature of communication, both formal and informal, is undergoing a real transformation. This transformation is reflected within the student bodies of colleges across the nation as text messaging, live personal video and internet voice communication become more evolved technically and entrenched in the psyche of our students. Student comfort levels with instant messaging, documented by these authors in previous papers[1,2], is only one sign of the changing communication tools and attitudes which will truly blur the line between actually there and virtually there. For example, students increasingly use instant messaging as a means of communicating with their peers and if we allow and encourage it, their college professors as well. Previous papers[1,2,3] have discussed using instant messaging to communicate with students outside the classroom. This paper examines and recommends some of the best practices for the effective use of instant messaging and other free web-based technologies to communicate with students.

Experiment & Survey

To better gauge student use, comfort levels and learning effects with instant messaging, the authors conducted an experiment in two different undergraduate engineering mechanics courses at the U.S. Military Academy at West Point, during the fall semester of Academic Year 2005-2006. The first course, CE300 Fundamentals of Engineering Mechanics and Design, is an introductory course in statics and mechanics of materials. During the semester in which the experiment was conducted, 209 students (in 12 sections) were enrolled in the course. All were non-engineering majors—students majoring primarily in the humanities and social sciences and taking CE300 as part of a three-course core engineering sequence. Most of these students take the course involuntarily, and even though all have completed four core math courses, two chemistry courses, and two physics courses prior to taking CE300, many lack confidence in their quantitative problem-solving skills.

Five instructors taught CE300 during the semester in which the experiment was conducted. Three of the five instructors (7 of the 12 sections being taught) used AOL Instant Messenger (AIM) and strongly encouraged their students to use it. The other two instructors did not use instant messaging. Of the three instructors using IM, two were relatively new to teaching (first and second year teachers) while the other had considerable experience. In no case did a single instructor use IM for some sections and not for others, so the control group was not ideal.

The second course is CE364 Mechanics of Materials. During the semester in which the experiment was conducted, 100 students (in 7 sections) were enrolled in the course. Nearly all were third-year students enrolled in an ABET-accredited civil engineering, mechanical engineering, electrical engineering, or engineering management major. Four instructors taught the course and two used AIM (4 of the 7 sections).

The purpose of the survey was three-fold. First, it was intended to investigate student comfort levels with IM. The first six questions on the survey provided insight into student comfort levels. These questions were:

1. Do you use instant messaging?
2. Please estimate the number of IM "conversations" you have per week...

For other than Academic Purposes	
Conversations with other cadets for Academic purposes	
Conversations with instructors for Academic purposes	

3. Did you use IM for communication with *your instructor* in any course other than CE300 or CE364?

       YES NO   If so, which course(s)?

4. What specific academic purposes do you prefer to use IM for? Check all that apply.

To check answers for Problem Sets or Review Problems	
Clarify course material or conceptual questions	
Discuss Non-course related material (i.e. questions about another course)	
Seek Professional Advice	
Other (Please list):	

5. On occasions when you used instant messaging to communicate with your instructor, why did you choose IM rather than a phone call or office visit?

6. How would you rate the following about IM? (Check ONE per question.)

Quality of communication:

	Excellent
	Above Average
	Average
	Below Average
	Poor

Convenience:

	Excellent
	Above Average
	Average
	Below Average
	Poor

The next two questions investigated student comfort level with IMing an instructor. The questions were:

7. ***At the start of the semester***, I felt comfortable instant messaging with my instructor.

	Strongly Agree
	Agree
	Neutral
	Disagree
	Strongly Disagree
	N/A. Did not use IM for academic purposes.

8. I feel comfortable instant messaging with my instructor ***now***.

	Strongly Agree
	Agree
	Neutral
	Disagree
	Strongly Disagree
	N/A. Did not use IM for academic purposes.

The last three questions examined the student's perceived effects on learning. Additional comments were also sought in a final freeform question.

9. Instant messaging helped me to learn more effectively in this course.

	Strongly Agree
	Agree
	Neutral
	Disagree
	Strongly Disagree
	N/A. Did not use IM for academic purposes.

10. Instant messaging contributed to a more positive learning environment in this course.

	Strongly Agree
	Agree
	Neutral
	Disagree
	Strongly Disagree
	N/A. Did not use IM for academic purposes.

11. Because it was so easy to contact my instructor for assistance, I did not work as hard in this course as I otherwise might have.

	Strongly Agree
	Agree
	Neutral
	Disagree
	Strongly Disagree
	N/A. Did not use IM for academic purposes.

12. Please provide any additional comments you have on the use of IM as a communication tool between instructors and cadets.

Survey Data Results

The survey was given to 121 students in CE300 and 51 students in CE 364. It was returned by 102 and 30 respectively for an overall turn-in rate of 76.7 %. We believe the high turn-in of surveys was due to the students' excitement with the technology and their desire to propagate this knowledge further. Of the students that turned in the surveys, 120 or 84.51% reported using IM. Those students that did use IM reported that they have on average approximately 74.5 "conversations" weekly. This includes a number of students who reported totals above 1000 conversations a week, which seems unlikely but is certainly an indication of their perceived extremely high level of use. For those at over 100 per week, many of the conversations are particularly "clipped", or short. Use of abbreviations (BTW for by the way, U for you, etc.) is also very common in high-volume IM users.

Even considering the outliers, the average number of conversations is surprisingly high. Most students (80%) rated the quality of communication of Instant Messaging only at an "average" or "above average" level. However, students rated the convenience of IM extremely high, with over 80% of students rating it as "excellent". It is believed that the convenience is the major attraction to students, and this is supported by some of the students' written responses to the survey. The data also show that the students are sophisticated consumers of communication technology; they are not blindly going forward with IM use due to a "fad" or just following a trend, they are aware of its uses and pitfalls, and they choose to use it deliberately.
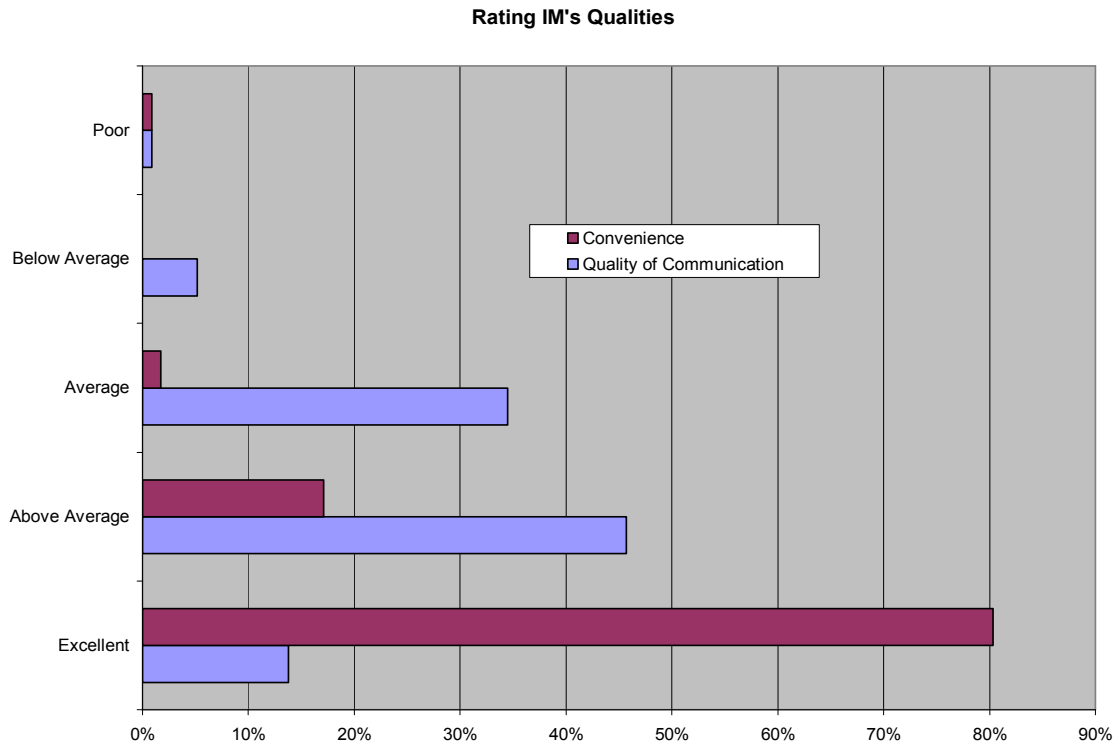
Rating IM's Qualities

Figure 1. Rating IM's Qualities.

Our overall confidence in the precision of the estimated number of conversations students have weekly is not high, since some students did not accurately answer the survey question. The actual question posed in the survey was "Estimate the number of IM conversations you have per week." In response to this question, many cadets provided highly imprecise or ambiguous answers (e.g., "lots" and "1000+"). As a result, we had to assign reasonable and conservative numerical values based on a judgment about these students' intent, which certainly introduces error into the analysis. In future studies, we will eliminate this problem through the use of closed form response options; e.g., '(a) 1 to 100, (b) 101 to 200, (c) 201 to 500, (d) more than 500.

Of the roughly 75 conversations that students have weekly on IM, 92% of them are not academic in nature. Only 8.3% of the weekly conversations reported were academic in nature, and only 1.3% of all conversations reported were academic in nature and with an instructor. One can infer from these data that this technology is not something that was used at the behest of the instructors, but is already being used as a primary means of communication between students for other purposes (most likely social). Also, only 1.69% of all students participating in the survey reported using IM with an instructor outside of the survey group. Since the survey group consisted on non-engineering majors from across the academy, it is reasonable to assume that few instructors use IM as a means of communication with their students. This is backed up by most students' evident surprise when given their instructor's screen name to use as another means of communication.

Those students that did choose to use IM for academic purposes primarily wanted to check answers for problem sets or review problems or to clarify course material or concepts. The following table shows a breakdown of the academic purposes that students used IM for.
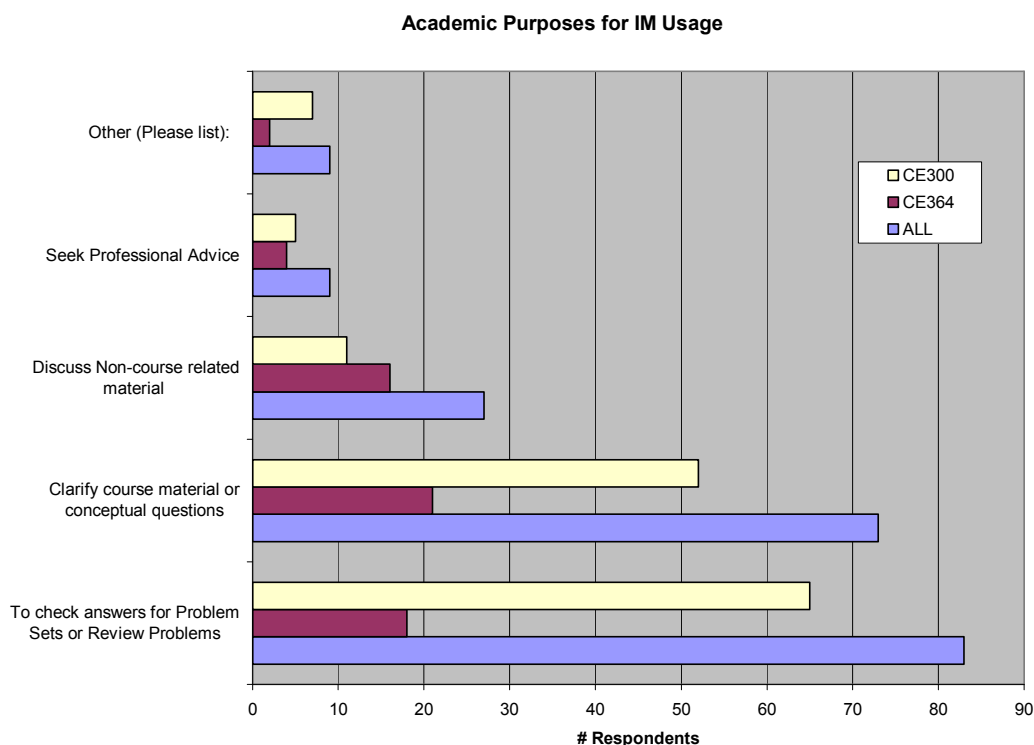
Academic Purposes for IM Usage

Figure 2. Academic Purposes for IM Usage.

When asked why they used instant messaging to communicate with their instructor rather than some other means, like a phone call or office visit, many students listed convenience, ease, and ability to multi-task as reasons. One student summarized his/her reasoning succinctly in the following statement. "IM is more convenient and I can do more than one thing at a time. Plus if I make a phone call and forget to ask something, then I have to make another call. IM provides open dialogue." Another wrote: "It's easier, I know he's available, I can ask questions as I work through the homework without having to call several times." The value of the ability to instantly know that the instructor is available cannot be overstated. Many students will not call because they do not want to inconvenience their instructor as evidenced by the following comment, "Less intrusive, I can see that he is online so I do not necessarily have to 'bother' him while he's at home with a phone call." This sense of not wanting to burden their instructor may come from a few possible sources. Students may feel that if they appear to know what they are doing, then they may do better in the course or possibly, they may feel that their questions are not important enough to warrant some of the instructor's time. A final possible reason is that they get the impression from their instructor that they are a burden. One way to reduce the students' impression that they are a burden is for the instructor to essentially carry on an online "study hall" of sorts, where several students can be helped simultaneously. One student specifically listed this as one of the reasons that he/she used IM; "Many other cadets were seeking help and IM's allowed the instructor to help multiple cadets at the same time."

While some students may have felt burdensome to their instructor, it is clear that the overall comfort level in using this technology with instructors increased greatly over the course of the semester. The overall percentage of students reporting that they either "agreed" or "strongly agreed" with the statement: "I feel comfortable instant messaging with my instructor" rose from 42% to 70%. The following table clearly shows this trend.

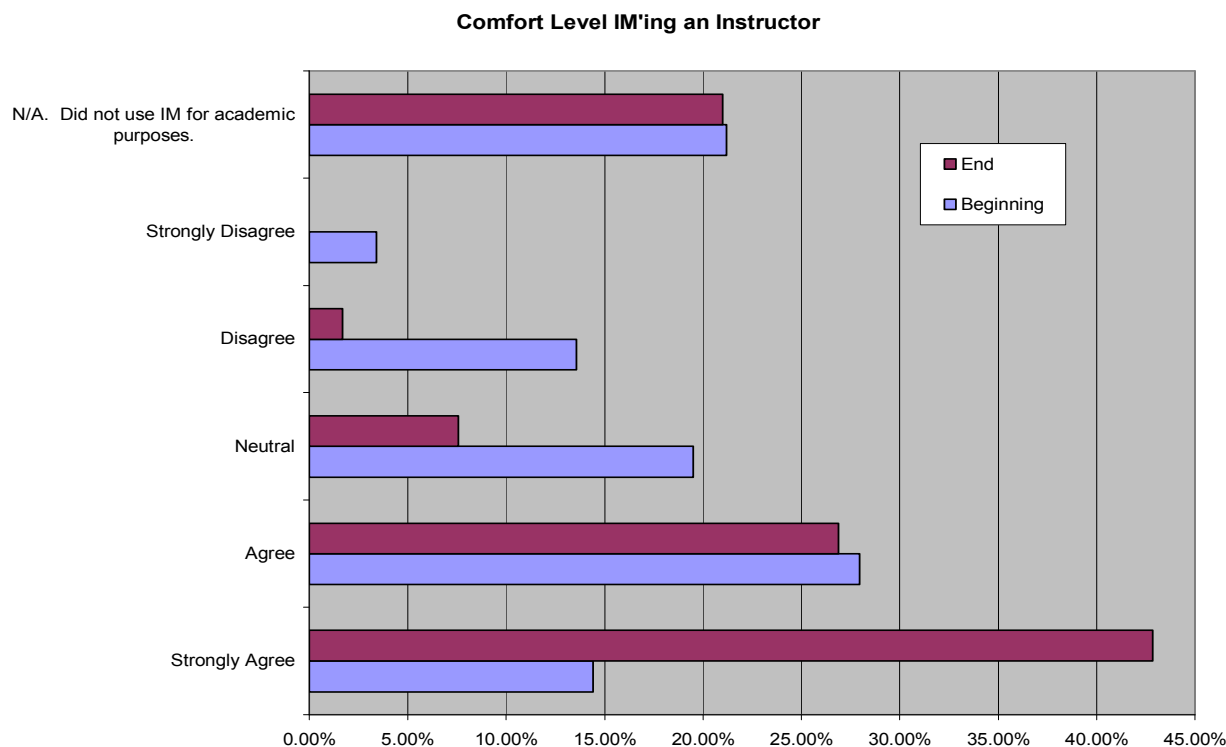**Comfort Level IM'ing an Instructor**

Figure 3. Comfort Level IM'ing an Instructor.

If this increasing comfort level of students with online interaction with the instructor is duplicated by increasing comfort in the classroom with the instructor, then it could be an extremely helpful phenomenon. Developing interpersonal rapport with students is one of the quickest ways to gain their trust and respect, and the resulting improvement in classroom climate tends to motivate students to work harder. While not all students took advantage of the instructor's availability through IM, it seems that those who did had an overall positive experience. Over 50% of students thought that it helped them to learn more effectively and that it created a more positive learning environment. Likewise, when asked if they did not work as hard as they otherwise might have due to their instructor's availability on IM, only three students answered the question affirmatively.
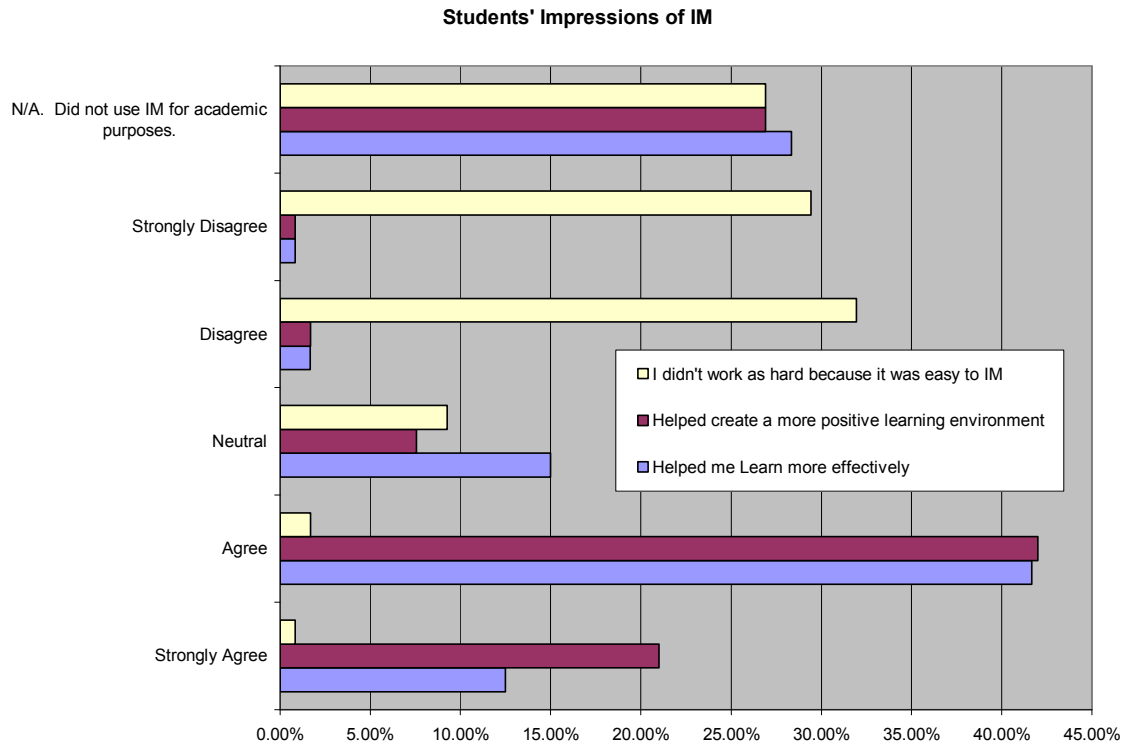
Students' Impressions of IM

Figure 4. Student Impressions of IM

Previous Assessments of the Effects of IM Usage

Several quantitative and qualitative assessments[1,2] are worth noting with regard to what may be considered best practices for IM usage. In the previous fall semester of CE300, 13 of 15 students in an IM section—in which the instructor used IM and carefully documented IM usage and student performance—chose to initiate at least one IM session with the instructor over the course of a 40-lesson semester.[1] All but two of the sessions involved requests for assistance on assigned homework problem sets, and 90% occurred outside of normal office hours—in the evening and within 48 hours of a homework due date.[1] These data suggest that most of the students were willing to *initiate* a conversation with the instructor via IM, and that the times they will seek out assistance via IM can be predicted from the course assignment schedule.

Predictability of student IM usage for assistance with homework can be used to establish IM "study hall" hours. An instructor may choose to log on to IM—from home, office, or anywhere an internet connection is available—during the predicted peak periods, thereby making himself or herself available to students when they are most likely to seek assistance on assigned homework through IM. Matching the instructor's available times on IM to the students' periods of need for instructor IM assistance would effectively increase the *efficiency* of the instructor-student "IM time" from the viewpoint of both parties. When the instructor is logged on, students will be likely to initiate an IM for assistance. When the students seek out assistance via IM, the instructor will likely be available. Also, IM's capacity for multi-tasking can prevent wasted time for one party while the other party is working on an interim task.

In the same previous semester of CE300, "…students in the IM section perceived—to a *significantly* greater degree than students in the non-IM sections—that they were able to complete course requirements within the allotted two hours per lesson."[2] However, "…surveys of *actual* student out-of-class time expenditure reveal[ed] *exactly the opposite result*."[1] The authors speculated that students who used IM to get homework assistance were less likely to experience frustration and more likely to work until they achieved a successful result. They spent more time, but perceived that they had spent less time. Because IM requests for homework assistance are largely concentrated in the 48-hour period prior to homework due dates, the added demand on faculty time—which can be significant if the instructor chooses to be available during evenings or weekends—is reasonably manageable. It can also be controlled by simply shutting down the system or logging off the screen name for instructional use.[2]

Correlations calculated between IM usage (number of sessions) and each of four different student performance measures shown Table 1 for the same semester of CE300 indicated that "students who used IM more frequently performed significantly better than their prior performance in math and physics would have predicted."[1] The R-squared value of 0.299 shown in Figure 5 indicated that 30% of the variation could be predicted as a linear function of IM usage.[1] The correlation coefficients also indicated that "students who used IM more frequently tended to perform somewhat better in the course,"[1] but that "…strong students were no more or less likely than weak students to use IM."[1] It was also observed that increased instructor encouragement of IM use had a strong positive influence on students' willingness to interact with their instructors via IM[1]. To summarize, weak students were significantly helped by the presence/availability of IM. This is perhaps the expected result, given that students who need help most will benefit most from the "instant" availability of that help.

Performance Measure	Correlation with IM Usage *(Number of Sessions)*
Overall GPA	-0.033
Math and Physics GPA	-0.051
CE300 Grade	+0.336
Difference between Actual and Expected CE300 Performance *(CE300 Grade)-(Math and Physics GPA)*	+0.546

Table 1. Correlation of CE300 grade to overall GPA and the GPA in math and physics courses.[1]
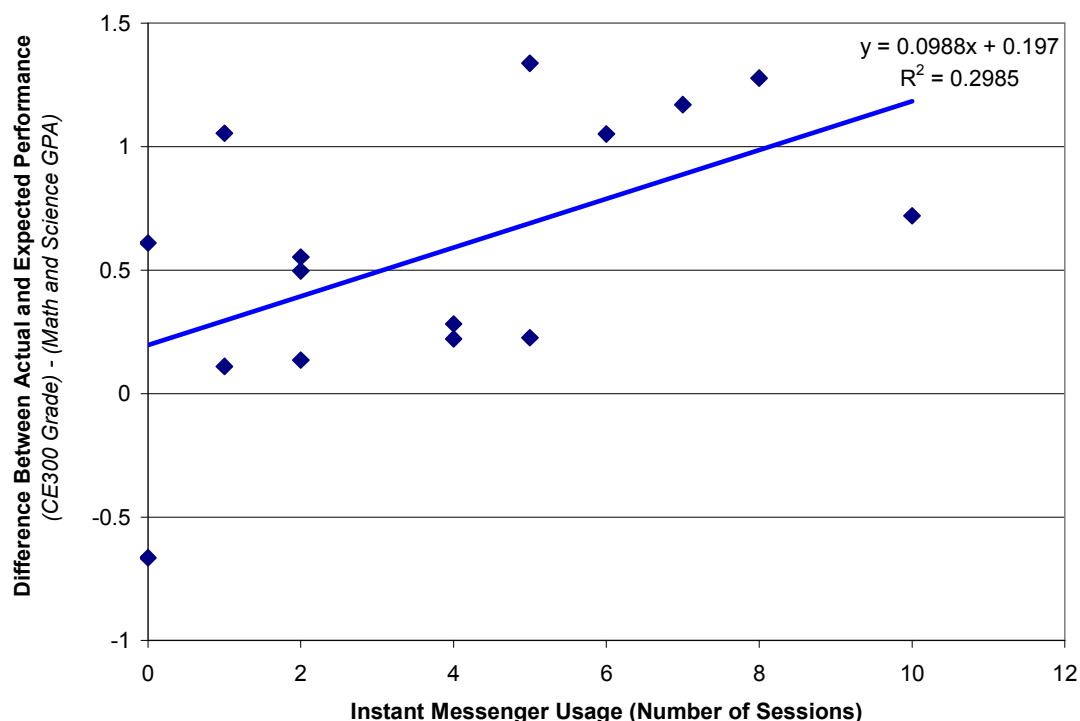
Figure 5. Comparison of Actual and Expected CE300 Performance vs. IM Usage.[1]

Instant messaging is most effective when the instructor does not answer students' questions directly, but instead responds with a question to help the student determine the solution.[2] When used to coach students through the solution in this manner, IM can effectively provide interim feedback and proved to be a powerful tool for performing *formative assessments*.[2] With the addition of a web camera, an inexpensive accoutrement, the use of sketches, symbols and other visual means of communication is now also possible with IM. If both parties have a web camera, the instructor may also see the student's written solution during the IM session and detect conceptual or procedural errors in a timely manner.

Comparison of Alternative Communication Media

By their very nature, current best practices in both engineering and education will always be based on a combination of observation, formal and informal assessment and experience. Some of the authors have been using IM extensively for student communication for three years, and though other near-equivalent methods are starting to creep in, IM remains the communication powerhouse most preferred by students, and with good reason; it meets the basic goals of student/teacher communication. Ideally, all communication with students, in and out of the classroom, should be focused towards accomplishing a few key goals[3]:

Goal 1: The student's understanding of the specific material being discussed should be increased. This is Imparting Knowledge.

Goal 2: The student's perception of the interaction should be positive. He or she should feel comfortable about approaching the instructor in the future. This is Comfort Level.

Goal 3: The seeds of desire for further knowledge should be planted, and the student should feel excited about in-depth pursuit of the subject. This is Intellectual Excitement.

Based on the authors' best interpretation of the data, in combination with experience, the performance of various communication technologies available to teachers could be summarized as follows:

Communication Mode	Goal 1: Imparting Knowledge	Goal 2: Comfort Level	Goal 3: Intellectual Excitement	Efficiency/ Time Spent	Availability/ Rapid Response	Mobility
Face-to-Face	Excellent	Poor to Good	Very Good	Fair	Poor to Fair	Very Poor
Telephone	Poor	Fair	Fair	Fair	Excellent	Fair to Good
E-mail	Good	Excellent	Fair	Fair	Good	Good
Instant Messaging (IM)	Very Good	Excellent	Good	Very Good	Very Good	Good
IM with video/sound	Excellent	Poor to Excellent	Very Good	Good	Very Good	Fair but improving

Table 2. Effectiveness of Various Communication Methods

With that assessment in mind, the authors offer the following observations on IM and IM with Video;

- IM is ubiquitous. If your students do not have it now, they will. Numerous studies, especially the numerous Pew studies from The Internet and American Life Project[4] show IM usage above 50% in college-age persons in the US.

- The Pew studies also show that IM is not a fad. The rapid growth in the number of users and the volume of use are both indicators that the technology is mature and entrenched. The proliferation of text messaging in the cellular arena is only another indicator of user desire for this type of interaction/communication. Further, the enterprises our students are likely to graduate into are very likely to be using IM or one of its cousins.

- Bandwidth, especially at universities, is continuing to grow rapidly, and compression schemes for video and voice are improving. IM now includes a video + voice option, and other free communication tools, such as Skype, offer similar enhancements. As that continues, mixed-mode e-communication, to include video, voice and collaborative settings where users can remotely view the screen of another user's screen will see significant growth.

- Wireless networks are continuing to proliferate, and fully mobile internet access at a low cost is already on university campuses and spreading quickly via internet cafes and the like. This means the demand for off-hours collaboration will likely rise, as students continue the never-ending quest to squeeze every ounce out of every minute.

- Students tend to be early adopters of new communication technologies. Professors and universities will have to be nimble and take some risks just to stay even with student demand.

Best Practices

All of this may seem a bit intimidating; where does a professor fit these things into an already crushing schedule? How do you manage these new communications tools, from identifying the key technologies to training yourself how to use them to finding the time to actually interact with students while still meeting the three basic goals? The authors recommend the following as best-practice for using IM and its cousins;

- Observe how your students communicate. They are sophisticated consumers of communication technology, and tend to choose the most efficient, effective tools through a process of elimination and according to the size of the user base. Immature users will tend to use the method they choose too much, perhaps to the detriment of their studies (see our students reporting 1000+ conversations a week!), but even the over-user will still choose efficient methods.

- Set limits on your availability. One of the most common "I can't do it" arguments heard from teachers is that using IM will take too much time. Like office hours, though, *it only needs to take as much time as you give it*. You can simply turn it on and off when desired, like opening or closing your office door. Establish hours when you will be available, then stick to them.

- Make yourself available at times that make it worth it to you and the students. Simply "Tuesday afternoons" will not really work, since that will be decoupled from the homework due dates. Students want the help when they are working on the problem, and like it or not, the information age is inspiring that behavior across the board, not just in education.

- Multi-task. If you watch your students during an IM session, they have 4 IM conversations going while using Excel and watching a live ESPN feed, all with IPod phones in their ears. Do not assume that you are observing an oddity or that they are being ineffective; observing your students and coming to the conclusion that they are *all* odd and/or defective is probably an indicator that you need to update your communication modes and methods.

- Stick to text alone when possible; your students do and there are good reasons for it. Adding video and voice can have two negative effects; first, you are pinned to the keyboard/office as long as the session lasts (greatly limiting multi-tasking), and second, the perceived barrier between the professor and the student is much higher.

- Add video where needed when the bandwidth is there to support it. Video saves significant time when passing equations, drawing a circuit or Mohr's Circle, or performing other highly visual tasks.

- Answer questions with a question. Avoid giving students answers or just saying "that's wrong"; lead your students through the process by letting them make small steps themselves. If you are multi-tasking, this can be highly efficient, since the time while a student is formulating an answer can be effectively spent elsewhere, like answering email, without diminishing the effectiveness of the communication.

- Encourage your students to use IM to communicate with you. The lower the perceived barrier, the higher the likelihood they will communicate.

- Use IM to increase access when you are away from the university. Many of the authors choose to offer IM hours in the evening after their family time. By offering help by remote in the evenings, you're offering help when students are working (increased learning), you're getting home earlier since your students will tend to come in less during the day if they know you will be available that evening (increased efficiency).

Conclusion

Instant Messenger and its cousins (Yahoo, MSM, Skype, etc) represent a very powerful tool for collaboration and teaching. Used correctly, and with the coming revolution of voice and video over IP, IM can greatly enhance student-teacher interaction, student-student interaction, inspire a truly collaborative learning environment, and significantly improve interpersonal rapport with students. Further, this enhancement can actually improve the efficiency of student-teacher interaction, since both parties can multi-task as the communication takes place. Although this represents a true revolution in communication, handled properly, this revolution holds some tremendous opportunities. Lastly, these tools are entering the enterprise space rapidly, and our universities must do our best to both educate our students using the best tools and prepare our students for their future workplace.

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