Embracing the middle ground: Engaging on- and off-campus students within the same 'classroom'

Leigh S. McCue[1] and Glenda R. Scales[2]

Abstract – There is little doubt that distance learning provides a host of opportunities for on- and off- campus students. For working professionals seeking a degree, often it is not an option to attend the University full-time. Distance learning programs provide the means to pursue an otherwise unattainable education. Likewise, on-campus students benefit from the virtual presence and expertise of off-campus students, who typically have more 'real-world' engineering experience than their on-campus peers. In this work, the authors' technological and philosophical approaches to distance education at the graduate level are presented.

Keywords: Distance learning, synchronous and asynchronous online education.

INTRODUCTION

This is an exciting time to be involved in distance learning. As hardware and software technologies present ever improving solutions to minimize physical distance, the distance learning instructor is left with a bevy of options for teaching on- and off-campus students in an engaging, interactive, and exciting environment. Virginia Tech students in programs offering courses/degrees via the University's distance learning program can be classified in three manners. *On-campus*, meaning a student who resides in proximity to campus and is physically able to attend class live, face-to-face with the instructor. *Off-campus-live*, that is a student who resides at a distance to campus or is otherwise unable to attend class on-campus, in person, but is able to attend an off-campus/virtual classroom. In this scenario the instructor teaches class from the main campus using a variety of distance learning technologies to engage students. The off-campus student interacts in real time with the instructor and other on-campus and off-campus students. *Off-campus-asynchronous*, students unable to attend class during a regularly scheduled meeting time either in person or virtually, but who instead review recorded lectures at their own schedule. It should be noted that most students will fall into two, if not all three of these categories within any given semester.

At the most fundamental level, as educators, we must engage our students, regardless of if they are on- or off-campus and attending live or asynchronous lectures. Institutions and departments may find it easy to inadvertently auto-differentiate on-campus students from off-campus students. While the same technical degree completion requirements are maintained, offering separate courses/sections for on- versus off- campus students results in simultaneously teaching the curriculum with two entirely unique styles, 'traditional' and 'online.' While this approach serves both student groups, it relinquishes the opportunity to capitalize on the numerous educational benefits available by simultaneously teaching both student groupings. For example, the diversification of technology required for teaching off-campus students can lend to improvements and innovations in delivery style of equal use to those on-campus. Additionally, teaching on- and off- campus students in the same virtual classroom provides a framework for students to learn from the experiences of their peers. These opportunities are most easily garnered by treating these two isolated student groupings as one and embracing the middle ground.

Virginia Tech is an established leader in distance education [IDDL, 7] with particular dedication to online education in the Ocean Engineering MS degree program [Brown, *et al.*, 3]. In the paper that follows, the authors discuss qualitatively a sample successful approach to online instruction, specifically, real time online lectures taught in a smart-board enabled classroom and/or using a tablet pc with on-campus students physically in attendance and off-

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campus students virtually present. Logistical hurdles encountered and pedagogy strengths are identified and addressed with differences between this format and video classrooms clarified. The specific instructional techniques discussed in this work are extrapolated to application to a research group with the goal of developing a sense of unity amongst a research group comprised of local and distance students.

PHILOSOPHICAL CONSIDERATIONS

Core beliefs

Students must be engaged; every instructor has their own mechanisms of engaging students in the material at hand, often through some combination of active learning exercises, demonstrations, personal interaction, etc…. Additionally, teaching should be fun. Instructors should look forward to entering the classroom so that their enthusiasm for the material is conveyed to students. The combination of on- and off-campus learners along with appropriate instructor motivation to introduce a high tech classroom allows for engagement of students in a new and different variety of ways. Ready links to external sources, convenient file sharing, classroom coding and simulation, the introduction of the tablet PC where students can be asked to freehand sketches and solutions and can see the sequential free-form thought process of the instructor are all innovations which greatly improve the enjoyment and interactivity of the classroom.

The distance learning teaching philosophy for the online Advanced Ship Dynamics (AOE5334) course is based upon three fundamental beliefs:

i. On-campus students should have the choice to attend class in person.

ii. Off-campus students should be served as effectively as on-campus students.

iii. Both student groups stand only to benefit from a joint educational experience.

Best practices that work

Operating on the assumption that (i) and (ii) can be accomplished with available technology, these three statements are not mutually exclusive. Thus the structure of the class involved meeting live three times weekly (scheduled from 5:10-6:00pm to accommodate the work schedules of employed students). On-campus students were encouraged to physically attend the real-time lectures. Off-campus students logged onto the lecture via software described in the next section. Anecdotal impressions indicate both student groups benefited from the physical presence of a group of students in the classroom for the following reasons.

- *Body language:* As all educators can attest, visual cues and student body language are enormously valuable sources of feedback for the instructor. From obvious input (falling asleep) to subtleties (a puzzled facial expression), these messages clearly translate to "we need an active exercise," "slow down," "we're confused," "what?" This silent body language of a few speaks volumes to express the needs of the group in turn allowing the instructor to most effectively serve on- and off-campus students.
- *Questions:* As a simple matter of reality, students ask more questions in person than live online. When a student poses a question, (s)he is rarely the only one puzzled in that manner. As such the increased level of question asking posed by on-campus students helps the off-campus ones as well.
- *Customer satisfaction:* On-campus students have expressed great satisfaction in having a choice of attending class live-in-person or live-online with the added benefit of having lectures recorded for further review. This seemed to have a cyclical energy effect of sorts. That is, happy on-campus students result in high levels of participation and lively discussions, which in turn enthuses off-campus students perpetuating the high energy level of the class on the whole. As an example, online students, for whom it could be easy to passively listen to lectures, instead find themselves caught up in the energy level of the classroom. During class exercises, it became routine to divide the class into groups a, b, c, and d, where d, or c and d, are comprised of off-campus students. The live online students, hearing the activity in the room, begin sending a flurry of text messages to formulate their response to the postulated question or mini-experiment. Without the in-room activity, there would be an added hurdle to evoke this sort of enthusiastic response.

In AOE5334 the task of engaging students in the material is easier, in many ways, than in undergraduate level courses. With graduate level students, many with work experience or in the working world, it is reasonable to expect the classroom interactions to be on a peer-to-peer level. First names are routinely used in the classroom; the most formal amongst the students refer to the professor simply as "doc." And the lecture format is oriented towards a "let's figure this out together" tone—enabled heavily by the use of technology in the classroom. That is, when the students struggle with how to numerically simulate an aspect of their homework assignment, technology enables the instructor to launch Matlab, Mathematica, or any other program to show a demonstration exercise or begin formulating the problem as an entire class.

Research applications

This philosophy coupled with the technology described in the subsequent section has been put to use in research group meetings to enable a sense of unity amongst on- and off-campus researchers. The first author's research group conducts approximately monthly whole group lunch meetings in which one student presents their latest findings. Transitioning to the online approach has allowed two off-campus students (one MS, one PhD level) to join the gathering (of approximately 4-6 on-campus students) and stay equally appraised of every group member's results. The first lunchtime presentation was given by one of the off-campus students to positive responses on the part of both on- and off- campus students.

TECHNOLOGICAL CONSIDERATIONS

The technological design of the course, AOE5334: Advanced Ship Dynamics, detailed herein, focused upon serving on- and off- campus students identically and simultaneously. Specific technological goals were as follows:

- Embrace new technologies to create a live interactive teaching and learning environment for on- and off-campus students.
- Minimize potential adverse impacts on traditional students; i.e. work to create an environment that will compliment rather than hinder the on-campus experience.
- Provide an online forum for students with work experience to share their knowledge/ expertise.
- Ensure the broad availability of the course; that is, use technology that does not require students to be at any specific physical location.

With advice and support of the AOE faculty and the University's Institute for Distance and Distributed Learning (IDDL), it was concluded that the software program Centra [Saba, 11] provided the best mixture of capabilities to meet the aforementioned goals. Centra is supported via University infrastructure including appropriate servers and training through Virginia Tech's Faculty Development Institute (FDI). In addition to real-time broadcasting of lectures, a desired software functionality for this course was the ability to record the real-time lecture. This capability in Centra proved of exceptional benefit to on- and off- campus students alike either in reviewing a lecture missed due to work-related travel or in repeating material for clarification. Without going into too much depth on Centra functionalities, other critical features include the ability of students to ask questions, either speaking or by text message, 'raise' their electronic hand, indicate problems or understanding with a check mark or 'X,' participate in break out discussions, even electronically smile or applaud. Additionally, applications can be 'shared'; for example, the instructor can show and run a Matlab script as an in-class example. A sample screen capture from a live class session is presented in Figure 1. Note the student checkmarks acknowledging comprehension of material and 'X' used in this case to answer a posed 'yes/no' question in the negative. This description of the selection and capabilities of Centra should not be read as an exclusive endorsement of any single software program. A number of powerful software tools exist for distance learning and/or teaching in a tablet PC environment including, but not limited to, Breeze [Adobe, 1], Camtasia [TechSmith, 13], Classroom Presenter [Anderson, *et al.*, 2] [UW, 14], ConferenceXP [Microsoft, 8], DyKnow [Dixon, *et al.*, 5] [DyKnow, 6]. Centra was chosen as an integrated solution for broadcasting both voice and slides while recording both items for future review. It is important to note that this solution, using the Centra software, will support a synchronous or asynchronous learning experience.

While room based interactive video conferencing solutions are appropriate for some learning environments, it was important that the instructional technology solutions for this class supported students learning at different times and in different places. In a recent survey of current Virginia Tech distance learning students, respondents were asked to indicate their preferred way of receiving instruction for distance learning courses, and as a departure from the results of a 2001 survey, the students surveyed in 2005 responded that their preferred delivery method is online as shown in Table 1 below [Scales, *et al.*, 12].

Method of Instruction	*Percent*
Via the internet-learning at the same time with instructor and students	36
Via the internet-(online) self paced	24
Interactive video teleconferencing in a room	20
Via the internet-some instruction self-paced and required face to face instruction with professor	16
No response	3

Table 1: Preferred way of receiving instruction for distance learning courses (from Scales, *et al.* [12]).

When asked what things students liked best about distance learning, the most frequently mentioned response was convenience [Scales, *et al.*, 12]. In fact, off-campus students in this course travel the country and/or world on work-related business, some even spent non-trivial quantities of time at sea. Thus it was of the utmost importance to maintain the portability of the 'classroom.' This response, convenience, is not unlike the top reason college students give for taking courses online [NSSE, 9].

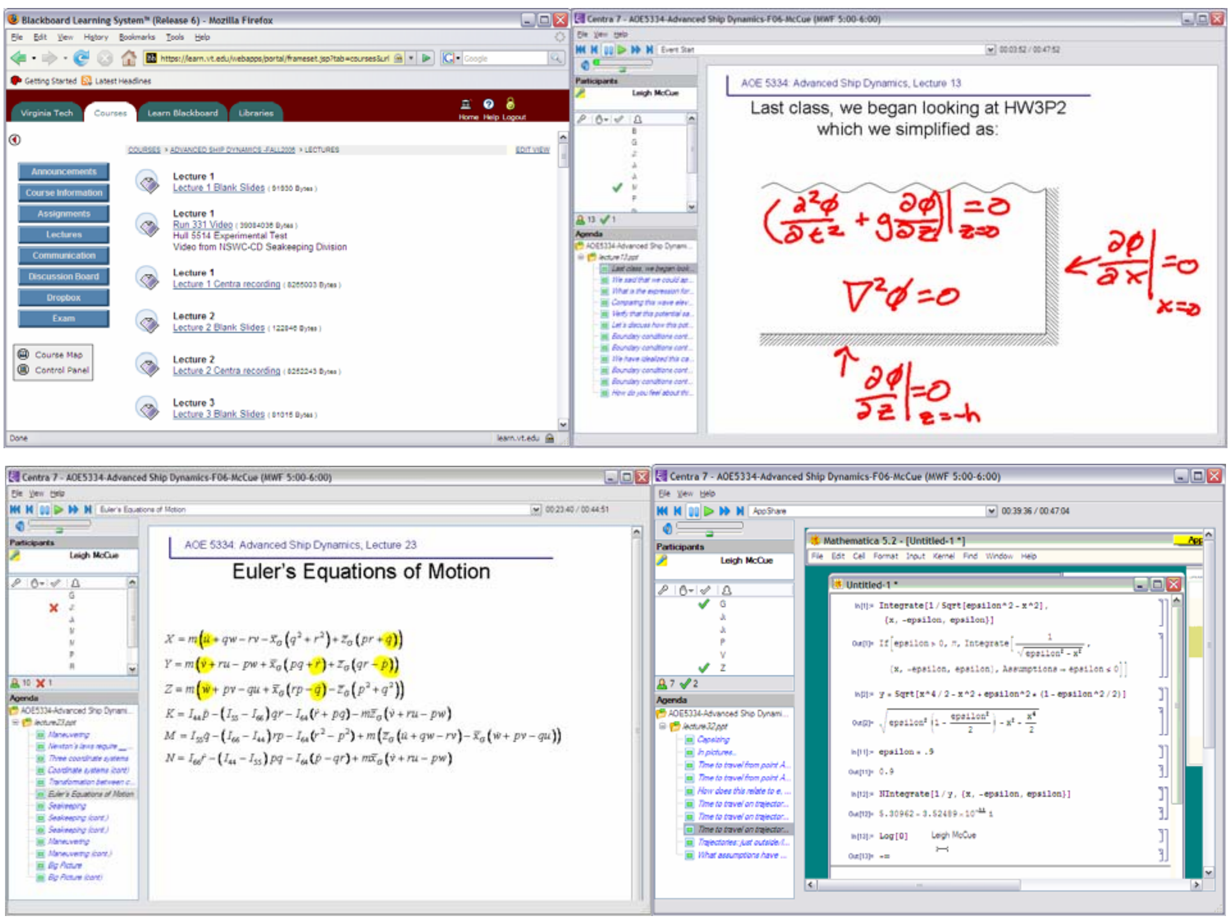

Figure 1: Snapshots of Blackboard frame and Centra slides during live class session.

(Student names removed digitally to preserve confidentiality.)

To compliment the software selected, two hardware approaches were tested in the classroom environment, a smart-board, and a tablet PC. A description of both approaches is presented in the next two subsections with qualitative discussion of respective strengths and weaknesses.

Smart-board

In the Fall of 2000 the College implemented the use of smart-board technology in order to provide an additional instructional technology tool to support faculty teaching via interactive video conferencing. At that time the smart-board provided faculty with new capabilities. Therefore, the initial hardware approach tested for this simul-teaching of on- and off- campus students was lecturing at a smart-board. In so doing, on-campus students attended lectures in a relatively traditional manner. Much like faculty commonly do in traditional classrooms, partial notes were disseminated online with written and oral extrapolation in class. However, the smart-board brought with it a handful of drawbacks, most notably, to use the functionality of the smart-board, the slide show application (PowerPoint) had to be 'shared,' rather than 'imported' into Centra. This resulted in recordings which could only be reviewed in their entirety, rather than slide-by-slide, posing a significant annoyance for students who wished to review the stored recording of the live class session. Additionally, calibration inaccuracies of the smart-board made for less clear and level handwriting than one would see on a traditional board or easily calibrated tablet PC. Lastly, because the primary slide show was a 'shared' application in Centra, the gestures of off-campus students (text messages, hand raising, check and 'X' marks, etc…) had to be monitored from different windows rather than all being available from the same view as the show itself.

Tablet PC

To address the issues present with smart-board usage, the instructor moved to lecturing/teaching from a tablet PC. Tablet PC usage is not new as a lecture medium; a very brief sampling of literature includes Anderson, *et al.* [2], Carryer [4], and Dixon, *et al.* [5]. However, from the distance learning perspective, this allowed for a number of improvements. First and foremost, the prepared slides were loadable into the 'agenda' function in Centra, which allowed students to review the lecture in a slide-by-slide manner while still allowing the instructor to write on the slide. This supported and enabled spontaneous interactions to a greater degree than the smart-board, where the instructor needed to regularly oscillate from the shared PowerPoint window to Centra. In follow up to an active learning exercise, the instructor could simply hand a student the tablet PC and have them sketch a figure or write out a formulation. Similarly, off-campus students could participate in the same manner by sketching a figure using the mouse or typing a solution. In the future, should tablet PC usage become more widespread, these capabilities would allow on- and off- campus students to pass back of the envelope answers amongst themselves and the instructor further enhancing active learning and lessening the perceived gap in 'face time' between on- and off- campus learners.

Microphones

A nontrivial hurdle in working to accommodate on- and off-campus students in the same virtual classroom arose in the selection of microphones. The idealized goals of the audio setup were to capture the speaker's voice clearly and wirelessly (to enable classroom mobility) as well as the sounds of student voices in the classroom.

As such, two different wired desktop microphones were tested with minimal success. Primarily, sound quality was dependent on proximity to the microphone and minimization of background noise. The approach served the goal of capturing sounds from within the classroom, but resulted in uniformly lousy sound quality. This led to frustrated off-campus students conference calling into the lecture room, a technologically, and potentially financially, excessive burden on the students.

As a second solution, a wireless Bluetooth headset was used by the instructor for transmission and recording of her voice. While this option required relinquishing the general ability to record classroom sounds, it substantially increased the audio quality on transmission of the instructor's voice. Some amount of classroom background noise was still transmitted such that online students benefited from the energy level in the classroom, as discussed above. The wireless nature of the Bluetooth device enabled full classroom mobility. So long as the instructor made a conscious effort to repeat all questions posed in the classroom, this technology was viewed as having all the benefits, with no insurmountable drawbacks, and thus superior to the desktop microphone.

Assessment

The course evaluations from this combined on/off-campus course offering were in support of the methodology described herein. A summary of online course evaluation results is presented in Table 2. All questions are asked on a 4 point scale with 1=poor/strongly disagree, 2=fair/disagree, 3=good/agree, and 4=excellent/strongly agree; a sample of the survey, which is distributed by IDDL for all distance learning classes, is available online [IDDL, 15]. The electronic survey was administered to on- and off- campus students alike. A separate paper survey with somewhat different question focus, typically used in traditional classes, was also given to on-campus students. As the emphasis of this paper is the interaction of on- and off-campus students, only the results of the electronic survey are presented below. All results from the "Technology Information" portion of the survey are presented below with additional results included from other categories that address the interactive nature and overall merit of the course.

	Class Results (# respondents)	***All eLearning Classes Results (# respondents)***
Category: Instructor Performance		
Success in communicating or explaining subject matter.	3.27 (15)	3.22 (2160)
Degree to which subject matter was made stimulating or relevant.	3.43 (14)	3.08 (2163)
Concern and respect for individuals as students	3.93 (15)	3.45 (2158)
Overall rating of this instructor.	3.67 (15)	3.34 (2163)
Encouragement and management of class interaction.	3.60 (15)	3.19 (2143)
Category: Course Design and Communication Information		
Course activities enabled my regular interaction within the class.	3.62 (15)	3.15 (2155)
Overall course design enabled my learning.	3.36 (14)	3.27 (2110)
Category: Technology Information		
The quality of technology and connectivity supported my learning.	3.13 (15)	3.31 (2139)
The technologies used in the course enabled my access to others.	3.40 (15)	3.27 (2131)
eLearning did not make me feel isolated.	3.20 (15)	3.13 (2128)
After completing this eLearning course I am more confident that I can reach my academic goals.	3.40 (15)	3.21 (2129)
My plans are to take additional eLearning courses.	3.13 (15)	3.16 (2128)
My learning in this eLearning environment was as effective as in other courses.	2.79 (14)	3.06 (2132)
I am satisfied with this eLearning experience.	3.13 (15)	3.19 (2120)

Table 2: Fall 2006 AOE5334 Student Perceptions of eLearning Highlights

For context when comparing course to University-wide statistics, this course was a required course for 92.31% of students in the class. For all online classes offered during the same term, only 35.74% of all respondents were taking a required course. That said, on the whole the course statistics compared quite favorably with those of all distance learning courses on campus. In particular, student surveys overwhelmingly indicated students felt the class was interactive and that they were not isolated by eLearning.

Under the "Technology Information" section the only question that generated a response below a 3.0 average for the respondents was: "My learning in this eLearning environment was as effective as in other courses." Based upon the additional student's responses on questions related to the Instructor Performance and Course Design and Communication of Information, students appeared pleased with the course design and instructor. It is perhaps the relatively new online learning experience that causes some students to feel that the traditional classroom is not yet fully replicated in the online environment. This is an area that warrants additional research. As software continues to evolve and improve it will be of interest to track how this statistic changes in time for both the course and the University. Also, to assess how the type of material affects these results, in future studies it would be of interest to compare course statistics to College of Engineering statistics, rather than whole University survey results. Because the very nature of class structure and material taught varies dramatically over the University's online programs (teaching, business, engineering…), a more informative comparison datum would be College of Engineering student perceptions of eLearning. While COE results are not available at the time of this writing, it should be noted that the rating on this item compared favorably to the aggregate rating over 3 recent Ocean Engineering courses [Brown, *et al.*, 3]. A few qualitative student comments regarding the instructor performance, course design, and technology from the online survey are included below:

> "I was very impressed with the organization of this class. the professor had no problems integrating virtual students into the classroom setting."

> "This class was interesting and interactive, making it effortless to understand the material and stay focused."

> "This class was the first time I have taken an elearning course and am very happy with the outcome"

> "I have taken 3 elearning courses including this one and I thought this was the best use of the technology at hand. I enjoyed the use of the smart classroom and the teacher utilizing the tools at hand to teach the information rather than talk to printed power point slides, as in my other 2 classes."

CONCLUSIONS

The qualitative discussion in this paper represents the experiences of one of the authors in her first experience simul-teaching on and off campus students. While a small amount of assessment was conducted through end of year course evaluations, it will be of benefit in the coming years to quantify student perceived successes and failures under this methodology and specifically compare to College of Engineering student perceptions. Particular attention should be paid towards identifying any success/failure trends which may be sensitive to the on-/off-campus status of students.

While there is distinct value in visual interaction in the form of eye contact, to the knowledge of the authors that technology is not yet viable within the context of e-learning aside from that used in video classrooms which carries the drawback of reduced portability *i.e.* requiring students to attend class in designated locations. Yet, video-conferencing is an area of great potential for future growth to enhance the off- campus experience as technological and logistical hurdles are systematically overcome [Patcha and Scales, 10].

Fundamentally, the approach outlined in this paper represents a fun, interactive, and effective classroom environment for on- and off-campus learners. The key of this class is that not only can students participate in the class from campus as well as across the world, but that the learning experience for the on- and off-campus students is enhanced through this process. One could involve an expert guest lecturer from anywhere whilst students download, listen, or live-participate in class from their living room or their quarters on a submarine. A professor traveling to a conference on another continent can report to the class on the state of the art of the subject at hand while thousands of miles away. Using this pedagogy, the world, in essence, is open.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge technical support from Virginia Tech's Institute for Distance and Distributed Learning, hardware support from Andrea Raines in the office of the Associate Dean for Distance Learning and

Computing, and methodology advice from colleagues in VT's Aerospace and Ocean Engineering Department, including Al Brown, Owen Hughes, and Wayne Neu. Additionally, Leigh McCue wishes to acknowledge Prof. Armin Troesch as the lecture notes and assignments for AOE5334 are based largely on his University of Michigan NA540 course.

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