Faculty and student feedback of synchronous distance education in a multi-university learning consortium

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Abstract

The Texas Learning Consortium (TLC) began as a partnership between the foreign language departments at 5 small, private, liberal arts universities, where each specializes in a small number of different world languages to increase the course offerings to their students without the expense of adding additional faculty on every campus. Each university offers their language courses to consortium students in a real-time, interactive, distance education format. In Fall 2017, the consortium expanded beyond foreign languages, and the first engineering course, Statics, was offered in this synchronous, distance format. As background, this paper will provide an overview of the technology used in the classrooms and some of the administrative obstacles that were overcome in scheduling, registration and information technology. The paper will also reflect on the impact of this particular technological implementation on various teaching styles in both foreign language and engineering courses, especially compared to other distance engineering education in the literature, with a purpose of analyzing the model's suitability for expansion into other engineering courses or a fully accredited consortium based engineering program. Student and faculty satisfaction surveys will additionally provide insight as to whether this distance format is the right fit for campuses used to high-touch learning environments.

1. Introduction

Engineering programs began expanding to both synchronous and asynchronous online course delivery in the late 1990s, but this medium could also be viewed as a new technology advancing tele-conferencing and video-conferencing that were in already used for at least a decade prior[1]. However, as a field, engineering has generally been much slower to move online than many others. Degree offerings are nearly all limited to masters and certificate programs, with only a handful of exceptions over the past several years. There are many reasons for this reluctance to offer bachelor's degrees online. It helps that a master's degree can shift online entirely within the department whereas a bachelors requires online courses from departments across campus. High use of projects and laboratories also favor a campus presence. However, a compelling reason that engineering should look to increase its distance offerings is to reach out to underrepresented populations (including but not necessarily limited to women, minorities, low income, and first-generation), many of whom attend small colleges and universities that don't currently offer an engineering degree.

Many students are drawn to small liberal arts universities on the promise of a high-touch educational environment, in which class sizes are small, and there is significant personal interaction with faculty and staff. The drawback to this small size is that the variety of course and program offerings can be highly limited. In these contexts, the possibility of online or distance education offers an alternative solution through which small universities can expand their offerings, without needing to shoulder the added costs of acquiring all of the additional faculty, space, and equipment that would otherwise be necessary to implement such programming. As an example, Concordia, Lubbock Christian, Schreiner, Texas Lutheran, and Texas Wesleyan Universities created a partnership in which each institution specializes in teaching different foreign languages, and through collaboration, all five programs can offer all five language options to their students. By combining the five student populations, each language program should receive enough student interest to remain viable while also reducing each institution's individual costs to maintain its language program.

From a pedagogical point of view, engineering programs are much more suitable to an online consortium model than the foreign language courses that were used to pilot the Texas Learning Consortium. Specifically, online collaboration through LifeSize or cloud based classroom technology creates notable obstacles to certain language learning outcomes that would not present issues in many engineering classroom environments. Aspects of the communicative teaching pedagogy that are especially important to promote successful L2 acquisition in the college classroom include the ability to maximize students' exposure to, and meaningful interactions with, "structured input" in the target language[2], and the ability to maximize the quality and amount of students' opportunities to produce "output" in interactive, task-based contexts. In any online format, satisfying the structured input requirement is straightforward, and many studies support a conclusion that student learning objectives for lecture type courses that focus on instructor supplied content are similar whether students take the courses wholly online, synchronous distance, or face to face, several recent of which are referenced here[3-5].

For obvious reasons, maximizing quality and amount of student output practice in an interactive setting cannot be easily replicated online[6]. In order to promote L2 acquisition, such task-based learning requires some form of real-time environment in which students can have one-on-one interactions with each other as well as receive spontaneous feedback about the output they are producing. Without these elements, certain cognitive processes that have been proven essential to L2 learning (hypothesis testing, "uptake", and attention and awareness to salient forms, among others) cannot be achieved with high success. This pedagogical style closely resembles the typical structure of an engineering design classroom that relies on small group interaction and peer feedback. Having interactions with others *in real time* is essential, making a face-to-face classroom environment (be it virtual or in-person) a vital element and necessitating that such interactions occur simultaneously in both student-to-student and instructor-to-student contexts[7].

This difficulty in implementing significant distance student-student interaction may not be as onerous for many lecture-style engineering courses. However, the larger concern may be that some studies show significant drop in student confidence and satisfaction, largely in the online population, but to a lesser extent even amongst the students in the classroom. These results do conflict with some seen in other fields, one of which noted no significant differences in satisfaction levels for distance education courses targeting rural business students[8]. These discrepancies in student confidence in their learning and program satisfaction are less of an issue when the online program is offered to adult professional learners[9], but could be detrimental for residential first generation undergraduate students or those from low income families for whom this discouragement is more likely to lead to non-retention. It is proposed that synchronous distance education may offer the best middle ground, allowing increased course offerings to residential students, while maintaining to the greatest extent possible, the high-touch educational environment that is the mission of the small university.

Facing decreasing enrollments in some foreign languages, many liberal arts universities are reducing the number of languages offered and variety of courses in remaining languages. The TLC was started to provide additional educational options to students at participating schools beyond those at each member institution alone. Engineering faces an opposite problem at these institutions, with increasing enrollment interest, and university resources not able to grow quickly enough to implement full programs. The solution however may be the same for both. An engineering consortium would allow increased offerings to students at only a fraction of the upfront and ongoing costs of developing and maintaining an engineering program[10]. The following sections of this paper will begin by describing the consortium formation, including both administration (scheduling, credit transfer, costs, etc.), as well as classroom hardware, software, and pedagogy used. Faculty and student survey results from 35 course sections over 4 semesters (Fall 2015, Spring 2016, Fall 2016, Spring 2017) will be analyzed and compared to results in the engineering literature to support previous findings as well as noted obstacles. Finally, future directions for both language and engineering consortiums will be proposed.

2. Academic Support Model

The learning consortium relies on professional courtesy, individual accommodations, and shared interests that fit naturally into small liberal arts university administration, but may not scale well to larger institutions where accommodating exceptions for large numbers of students or courses could be burdensome. This section will elaborate on the models used to resolve issues in daily schedules, overall academic calendar, learning management systems, course credit and finances.

Participating schools do not have standardized class times or duration of breaks between classes. This could make it more difficult for a student to create a class schedule without conflict since a remote course will likely conflict with two time blocks on their own campus, not just one. In practice, this has not shown to be a significant issue for students beyond their normal scheduling challenges. The more difficult problem arises from each campus currently having only 1 or 2 classrooms equipped with the technology required to conduct consortium classes. The significant takeaway is that where a normal classroom may be able to support about 8-10 classes throughout the day, in the worst case, a consortium classroom may only be able to support half that number. This is further reduced for campuses on which these classrooms are also required so support other meetings or department classes. The low class yield of a fully utilized consortium classroom must be taken into consideration by registrars in making course schedules, and also by the administration in their campus infrastructure plan if the engineering program were to grow.

Participating institutions often have different academic calendars, with their own start dates, exam periods, and breaks. Learning consortium class schedules are generally a conservative combination of the schedules for all students enrolled. For instance, in Spring 2017, Engineering Dynamics has students enrolled from Lubbock Christian University and Schreiner University with LCU starting and ending a week earlier than SU. By restricting the course to when both schools are in session, the 15 week course is fit into 13 weeks of overlapped time.

Besides the first day of class, there are also different fall breaks, spring breaks, final exams, etc. The Consortium Coordinator is a faculty member at one institution who acts as program director and distributes the calendar information to teaching faculty and the faculty will make their own course calendar, depending on the composition of their class. When mid-semester breaks don't line up, the time is usually salvaged with out of class projects or take home exams.

Students are not required to apply for admission to another university to take TLC courses. There is no credit transfer needed since all the consortium courses are listed as local courses in each university's catalogue. If students complete the course, they will receive full credit from their own institution, not transfer credit. Instructors teaching TLC courses are essentially 'cross-listed' as instructors at each institution, not solely at their home university. This creates only minor paperwork (sharing faculty CVs and transcripts) so each school can certify faculty credentials for their own accreditation processes. There is no direct financial benefit to the faculty members in this arrangement.

Students register for courses in their own institution's system. Prior to the start of each semester, registrars send the minimal amount of individual information to the other universities to allow those schools to create LMS accounts for the remote students and have time to transmit the login information before the first day of classes. Granting access to the LMS as early as possible is crucial to keeping students informed of the unusual academic calendar practiced in consortium courses.

Each summer, the universities rotate hosting a 2-day meeting attended by faculty, technologists, registrars, and administrators from each participating institution. Many of the previously mentioned issues are thus resolved for the upcoming year well in advance. For faculty, this meeting contains training sessions on blended classrooms, to take advantages of the strength of online asynchronous content delivery, and encourage as much student interaction as possible during the class period. As noted in previous studies, migration to a virtual classroom requires changes in pedagogical technique of the instructor[11], so this training is essential, especially for those that have only taught in a face-to-face format previously. This training is supplemented at each campus with individual meetings between the faculty and their technologist to learn the equipment in their classroom as well as basic troubleshooting. Each campus does have a staff member or work study on call during consortium classes to assist with technology troubleshooting if disconnects occur during a class.

As each university stands to gain from the overall success of the consortium, administrations at each school agreed that there would be no inter-university billing for tuition based on enrollment. All students pay their normal tuition to their own university and are able to enroll in any consortium class free of charge. The enrollment numbers have vastly differed from semester to semester, and so has the proportion of students each school has been hosting or sourcing. With a goal to provide students as many engineering and language options as possible, while keeping the possibility of low enrollment classes being cancelled to a minimum, all institutions share both resources and risks.

3. Classroom Model

The technological setup in the classrooms is generally similar to those used by some synchronous engineering courses at other universities[12-14], and Figs. 1-2 photograph one institution's classroom from both the student and instructor perspective. Prior to Fall 2017, all schools used Lifesize HD Video Conferencing, however, several schools have since transitioned to cloud services (BlueJeans). Hardware slightly differs on each campus, but at a minimum each classroom contains:

- 2 HD cameras (or 1 camera that can be moved by remote control) to allow viewing of the professor or the seated students depending on whether the room is used to host or remote into a class.
- Computer with internet connection for content (presentation)
- Lavalier microphone for instructor
- Microphones for in-class students (ceiling mounted for ambient sound or tabletop for individuals)
- Room speakers

The classroom used for teaching Statics in Fall 2017 and Dynamics in Spring 2018 is equipped to provide content to distance students on PC (PowerPoint or similar) or document camera, and through a camera directed at a whiteboard. Note that the PC or Document Camera can be used simultaneously with the camera/whiteboard since distance students have 2 screens available to them. The result is that any lecture content provided on PowerPoint or whiteboard in a typical live classroom can be easily duplicated in the distance format. As a specific example, many statics students find it difficult to analyze 3D geometry. This is not because the solution technique is more difficult, the same equations are used as in the 2D case, they just require additional spatial reasoning skills to analyze the 3D shapes when displayed in the 2D textbook page or projector screen. This problem is neither fixed nor made worse in the synchronous distance format. That is, the ability for students to follow the discussion largely depends on the professor's skill at making clear drawings on the board, or the students' ability to interpret 3D drawings on the projector screen.

However, the live classroom does provide an additional tool that is significantly hampered in the distance format, presence. Teaching labs, even those as simple as bringing a tennis ball to class that can be thrown to represent projectile motion, are less impactful for distance students. While live students can very easily trace a ball's 3D path as it is thrown, this demonstration does not translate well over the camera to distance participants. These sorts of fast, inexpensive demonstrations including balls, blocks, ramps, and similar devices are useful to help build intuition in Statics and Dynamics classrooms to explain projectile motion, friction, and other fundamental concepts, especially when modeling a 3D system where drawings or pictures may be confusing. However, when these live demonstrations are shown on a 2D screen, the remote viewer has a much more difficult time gauging speed, direction, and angle for any moving object, especially if any component of that motion is in the depth direction, towards/away from the camera.

The most successful faculty members have made intentional changes to their pedagogical technique when teaching consortium classes. Those that hoped to use the same style and merely ask students to submit homework online have faced significant difficulty. The most notable challenges observed that differentiate the synchronous distance classrooms from face-to-face are:

- Small group work can be difficult, especially across institutions. This is more an issue of in-class group work due to camera and microphone positions in the rooms. Out of class, inter-institution student collaboration is typically much easier.
- Certain hands-on activities and teaching labs may become impractical or less impactful. In Fall 2017, Statics student projects involving force sensors were converted to classroom demonstrations since remote students did not have access to the same equipment.
- Some distance learners may feel uncomfortable facing a camera that records all their movements.

Faculty members are encouraged to redesign their courses into a blended format. The *input* component of students' learning experiences can be moved to an online environment with much greater ease than their output practice. Online platforms can readily provide students with textual and audiovisual materials with which they can practice problem solving, and textbook publishers (for example, Pearson's Mastering Engineering) are currently dedicating enormous resources to the development and delivery of such platforms. However, in foreign languages, universities that have adopted *entirely* online programs have only met with varying success. Such online programs struggle to fully consider and address the importance of task-based learning or of the roles played by the cognitive processes of "attention" and "awareness" in L2 acquisition[15-17].

Creating and maximizing opportunities for students to *interact* with meaningful structured input, while also possible in the online context as well as in the video conferencing classroom environment, can often be more challenging to achieve with the same degree of effectiveness as the traditional classroom for several reasons. For best learning outcomes, careful consideration must be given to creation of pedagogical tasks that force learners' "attention" as well as their "noticing" of the targeted forms[17], something that is difficult to achieve in wholly online contexts and much easier to achieve in a synchronous learning environment. A synchronous learning environment can successfully fosters students' ability to practice hypothesis testing and negotiating meaning[18], as well as to receive individualized peer and instructor implicit and explicit feedback in real time in response to a variety of spontaneous output[19]. For engineering problems, this would better allow generalization from one problem formulation to another as opposed to students' natural tendency to view trivial wording changes as completely different problem types.

Presentation of input for students should privilege a "focus on form" over a "focus on form*S*"[20] in a combination of implicit and explicit orientations[21-23]. In engineering applications, this would be comparable to avoiding lengthy derivations in situations where focusing instead on real world applications can provide both fundamental intuition and practical knowledge. Student-to-student interaction in pairs or small groups should be used to enhance output practice in task-based interactions. A blended learning model sufficiently reallocates class time to these activities.

4. Student and Faculty Feedback

Countless previous studies have shown that similar learning outcomes can be achieved in a variety of delivery formats, however, the research methodologies, sample sizes, and accountancy of outside variables is often inconsistent or inadequate in these types of work[24-25], making it difficult to generalize the results. Instead, engagement and satisfaction were the focus of the student survey, not outcome achievement. Even after 4 semesters, these results cover a relatively small sample size, however this feedback does provide a unique contribution due to the consortium format where the students taking distance courses are all full-time undergraduates, merely on different campuses. If it is the mission of small private universities to deliver a high-touch educational experience, student feedback is a key indicator of whether that goal is being met, especially when compared directly to faculty answers to the same questions.

Surveys were given to all 35 learning consortium course sections that had at least one distant student enrolled following the Fall 2015 – Spring 2017 semesters. 81 students responded, of which 51 were located on campus with their professor, and 30 connected remotely.

Similar surveys were also conducted after the Fall 2015-Spring 2017 semesters of faculty teaching TLC courses. A total of 24 survey responses were received. Their feedback will shed some light on the effectiveness of the technology used and overall classroom model, as well as areas of training and system improvements required.

Figures 3-4 show faculty and student feedback regarding the technology used in their classroom. Analyzing these two figures together suggests that the video conferencing technology is easy to use, but difficult to troubleshoot when problems arise. The consortium first attempted to deal with this discrepancy by having IT staff on call near the classrooms so they are able to respond quickly when technical problems occur. However, a pre-emptive approach is preferred and starting in Fall 2017, most consortium schools switched to cloud-based video conferencing to increase system reliability and reduce the number or duration of dropped connections. Using the new BlueJeans account in Fall 2017, Engineering Statics only had a single connection issue all semester, which lasted about 15 minutes. Anecdotally, this is a significant improvement over the LifeSize video conferencing system used in 2015-2017.

Figures 5-6 together analyze the perceived effect of the technology on teaching/learning. The results at first seem to conflict with each other, in that faculty and students generally agreed that interactions in the classroom were still easy despite the distance format used. However, many students and faculty also agreed that the technology was a barrier to their learning/teaching since the average response in Fig. 6 has visibly shifted in the 'disagree' direction as compared to Fig. 5. Analyzing these together suggests that the barriers are not pedagogical, and that both faculty and students are comfortable working and interacting in the synchronous distance classroom. Instead, it is likely that the barriers described in Fig. 6 result instead from the occasional dropped call, or audio/visual issues. In future semesters and years, this proposed relationship can be confirmed if more faculty and students agree that the technology was not a barrier, now that a more reliable cloud-based system is used.

It is worth clarifying that the prompt used for Fig. 5 asked faculty whether it was easy to interact with students, and students whether it was easy to interact with their professor. Students were also asked in a separate question if they agreed that it was easy to interact with other students. Surprisingly, the average response to this question was nearly identical (on a 5pt scale with 1 representing strongly disagree and 5 representing strongly agree) with the difference between responses to these questions being within 0.1 of each other every semester. Since the room hardware makes it easy for anyone to talk to everyone, but very difficult for some specific individuals to only talk to each other, it was expected that this would have resulted in students finding it more difficult to communicate with other students. Anecdotally, in Fall 2017 Engineering Statics, it was observed that the video conferencing was not an impediment to "speaking up". Both local and distance students regularly interrupted to ask questions or respond with answers. However, it was rare for local and remote students to speak to each other unless specifically prompted.

From the faculty perspective, there is a single common theme across all their responses to the "other comments" survey prompt. Duplicating the face-to-face experience in a video-conference format is difficult and takes intentionality, course redesign, and proper use of the best available technology (including personal devices).

On all surveys, students were asked an open ended question of what they liked least about the course. All 4 semesters, about a third of students indicated that the video conferencing was what they least liked about the course. Some of these comments specifically mentioned disconnects, and discussions with staff at several campuses indicate that these disconnects predominantly occurred in the first few weeks of class, but even if they did not occur regularly all semester long, survey results indicate that their influence lingered all the way through the semester and left a lasting negative impression. Other comments more generally indicated that students in the same room with faculty found that the video conferencing lessened the experience instead of adding value.

There were several important takeaways from this selection of comments. It was not only the distant students who were frustrated by technology. As noted in previous engineering studies[26], even some students on campus with the instructor felt that the inclusion of the distance students created an unnecessary distraction that lowered the quality of their experience. Comments here from distant students were split, with several viewing the technology as a barrier to their learning, which is a similar result to some previous studies[27]. However, others chose instead to focus on their thankfulness that they were able to take the course that otherwise would not have been available. Finally, several students were unhappy with the low amount of student-student interaction. They did not tie these comments directly to the technology so this may have simply been a pedagogical choice by the professor to primarily lecture. Previous studies have noted that synchronous classrooms suffer from unequal participation among students, favoring face-to-face students over distance[28]. Several students in this study indicated similar concerns in their survey feedback, and even faculty noted the difficulty in interacting due to it being harder to read body language.

5. Future Directions

The use of personal or classroom housed devices with break-out room capable software would significantly enhance the classroom experience by facilitating one-on-one student interactions in real-time, allowing for better implementation of task-based activities in pairs and small groups that enhance amount and quality of student output practice during synchronous distance instruction.

With 2016 releases of HTC Vive and Oculus Rift, as well as ongoing support and development of a number of VR and AR alternatives, a technological jump to a fully virtual classroom may become realistic in the next decade. Proof of concept studies have indicated excellent student interest and engagement in courses utilizing this type of technology[29], and it may allow a greater sense of personal connection and immersion than other distance options, thereby supporting the mission of small universities. Another advantage is that in VR, all students would share identical experiences, eliminating the imbalance where local and remote students receive slightly different experiences currently.

Through the TLC, each university can leverage existing infrastructure to initiate an accredited engineering program for a fraction of the up-front and ongoing costs of developing one on their own by sharing personnel expenses and construction costs of labs among the alliance member universities. Further the TLC would delineate each member's responsibility to the alliance through Memorandums of Understanding documents (MOUs). Over the coming years, the alliance leadership team, supported by their administrators and STEM faculty will continue to develop the consortium engineering program's educational and financial models to assess viability, risks, and opportunities for a consortium based full engineering major.

6. Conclusions

There are many factors that contribute to the value of a learning consortium. Students value additional course and program choices. Faculty value teaching upper level courses that otherwise might not reach minimum enrollment if only drawing from their own campus. The administration values low cost solutions that take advantage of peer resources, rather than attempting to duplicate. However, it is not clear whether this added value for each group overcomes the negative impressions left by occasional technological glitches and real or perceived changes in education quality. The most significant findings in this study were:

1. Unexpectedly, the only students who indicated that they would not be willing to take a consortium course as a distant student were those enrolled in courses whose faculty member was on their campus. Though many distant students indicated frustration with some aspects of the technology, none indicated that they would not take another similar course.
2. This suggests that expanded course offerings can be sufficient motivation to drive attendance amongst distance students, even in the presence of occasional video and audio glitches. However, faculty must intentionally demonstrate added value of including the distant students in the class to their local students, so that the local experience is enhanced, and avoid the situation where some in this program felt that the faculty member was overly distracted.
3. Though an engineering consortium may reduce costs by dividing the construction responsibility for major laboratory courses between them, the costs of smaller teaching-lab equipment should not be overlooked. If these costs are not duplicated at all member universities, many hands-on projects built into lecture courses could not be completed during the semester if the equipment is only at one school.

Formation of a learning consortium provides an opportunity for small universities to share resources and provide academic opportunities without significant added expense. Student and faculty feedback have indicated that all faculty and most students would continue teaching or learning in the consortium format. While other formats could potentially be more reliable, real-time video-conferencing maintains the high-touch classroom environment that is in line with each university's mission, and through additional technological advancement and pedagogical development, satisfaction with the classes can be further increased. Adding a small number of engineering course offerings to the TLC schedule is one step towards assessing the viability and value of a consortium engineering major.

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References

[1] G. Rafe and J. H. Manley, "Assessing Quality Issues in Interactive Video Teleconferencing-based Graduate Level Engineering Courses," *Journal of Engineering Education,* 88(1), 119-128, 1999.

[2] J. Douglas, "Comparing Learning Outcomes and Content Mastery in Online and Face-to-Face Engineering Statics Courses," in *122nd ASEE Annual Conference & Exposition*, Seattle, WA, 2015.

[3] B. W. Caldwell and C. Halupa, "Exploring Video-Intensive Delivery in an Online and Face-to-Face Statics Course," *Journal of Online Engineering Education,* 6(1), 1-10, 2015.

[4] R. Phipps and J. Merisotis, "What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education," *Change: The Magazine of Higher Learning,* 31(2), 12-17, 1999.

[5] M. R. Phillips and M. J. Peters, "Targeting Rural Students With Distance Learning Courses: A Comparative Study of Determinant Attributes and Satisfaction Levels," *Journal of Education for Business,* 74(6), 351-356, 1999.

[6] R. M. Bernard, P. C. Abrami, E. Borokhovski, C. A. Wade, R. M. Tamim, M. A. Surkes and E. C. Bethel, "A Meta-Analysis of Three Types of Interaction Treatments in Distance Education," *Review of Educational Research,* 79(3), 1243-1289, 2009.

[7] J. Bourne, D. Harris and F. Mayadas, "Online Engineering Education: Learning Anywhere, Anytime," *Journal of Engineering Education,* 94(1), 131-146, 2005.

[8] C. Williamson, J. T. Bernhard and K. Chamberlin, "Perspectives on an Internet-Based Synchronous Distance Learning Experience," *Journal of Engineering Education,* 89(1), 53-61, 2000.

[9] E. Rutz, R. Eckart, J. E. Wade, C. Maltbie, C. Rafter and V. Elkins, "Student Performance and Acceptance of Instructional Technology: Comparing Technology-Enhanced and Traditional Instruction for a Course in Statics," *Journal of Engineering Education,* 92(2), 133-140, 2003.

[10] S. F. Midkiff and L. A. DaSilva, "Leveraging the Web for Synchronous Versus Asynchronous Distance Learning," in *International Conference on Engineering Education*, Taipei, Tainan (Taiwan), 2000.

[11] J. Mayrose, "Active Learning Through The Use Of Virtual Environments," *American Journal of Engineering Education,* 2(1), 13-18, 2012.

[12] J. M. Pullen and P. M. McAndrews, "Low-Cost Internet Synchronous Distance Education Using Open-Source Software," in *American Society for Engineering Education Annual Conference & Exposition*, Salt Lake City, UT, 2004.

[13] A. N. Abdelmessih and I. Gendelman, "Synchronous Distance Learning For Undergraduate Thermal Engineering Courses: Trials and Improvements," in *ASEE Annual Conference and Exposition*, San Antonio, TX, 2012.

[14] C. J. Lesko Jr., "Blending on-campus and online experiences through the use of virtually immersive technologies," *Journal of Online Engineering Education,* 2(2), 1-10, 2011.

[15] A. Francis, C. Larkin and S. D. Aslinia, "Interaction in Online Courses," *Journal of Online Engineering Education,* 1(1), 1-4, 2010.

[16] M. Holdhusen, "A Comparison of Engineering Graphics Courses Delivered Face To Face, On Line, Via Synchronous Distance Education, And In Hybrid Formats," in *ASEE Annual Conference and Exposition*, Austin, TX, 2009.

[17] M. Cavalli, J. J. Neubert and D. Worley, "Comparison of On-Campus and Distance Learning Preferences in a Junior-level Materials Science Course," in *121st ASEE Annual Conference & Exposition*, Indianapolis, IN, 2014.

[18] A. Sher, "Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in Web-based Online Learning Environment," *Journal of Interactive Online Learning,* 8(2), 102-120, 2009.

[19] R. Bernard, P. Abrami, Y. Lou, E. Borokhovski, A. Wade, L. Wozney, P. Wallet and M. Fiset, "How Does Distance Education Compare to Classroom Instruction? A MetaAnalysis of the Empirical Literature," *Review of Educational Research,* 3(74), 379-439, 2004.

[20] P. Robinson, "Attention, Memory, and the Noticing Hypothesis," *Language Learning,* 45, 283-331, 1995.

[21] R. P. Leow, "A Study on the Role of Awareness in Foreign Language Behavior: Aware vs. Unaware Learners," *Studies in Second Language Acquisition,* 22, 557-584, 2000.

[22] R. P. Leow, "Attention, Awareness, and Foreign Language Behavior," *Language Learning,* 51, 113-155, 2001.

[23] S. M. Gass and E. M. Varonis, "Input, Interaction, and Second Language Production," *Studies in Second Language Acquisition,* 16, 283-302, 1994.

[24] B. VanPatten and J. F. Lee, "Second language acquisition / foreign language learning" in *Multilingual Matters Ltd*, Clevedon, 1990.

[25] M. H. Long, S. Inagaki and L. Ortega, "The Role of Implicit Negative Feedback in SLA: Models and Recasts in Japanese and Spanish," *Modern Language Journal,* 82, 357-371, 1998.

[26] P. Robinson and M. H. Long, "Focus on Form: Theory, Research and Practice," in *Focus on Form in Classroom Second Language Acquisition*, New York, Cambridge University Press, 15-41, 1998.

[27] P. M. Lightbrown and N. Spada, How Languages Are Learned, Oxford: Oxford University Press, 1999.

[28] R. DeKeyser, "Beyond Focus on Form: Cognitive Perspectives on Learning and Practicing Second Language Grammar," in *Focus on Form in Classroom Second Language Acquisition*, Cambridge, Cambridge University Press, 42-63, 1998.

[29] B. Vanpatten and C. Teresa, "Input Processing and Second Language Acquisition: A Role for Instruction," *The Modern Language Journal*, 77(1), 45-57, 1993.

Fig. 1 Student perspective in a consortium classroom shows student directed cameras on the left projector and the instructor's presentation on the right projector.

Fig. 2 The instructor's monitor also shows the remote students.

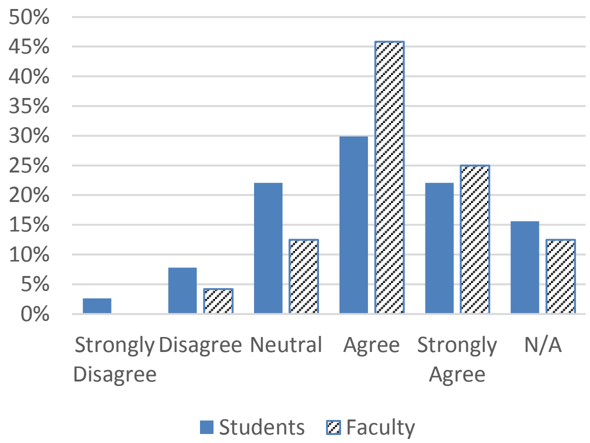

Fig. 3 "The technology setup at my institution was easy to use."

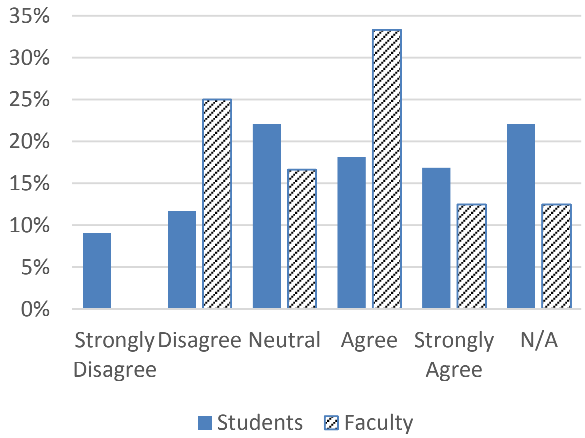

Fig. 4 "I was always able to connect for class via the bridge connection."

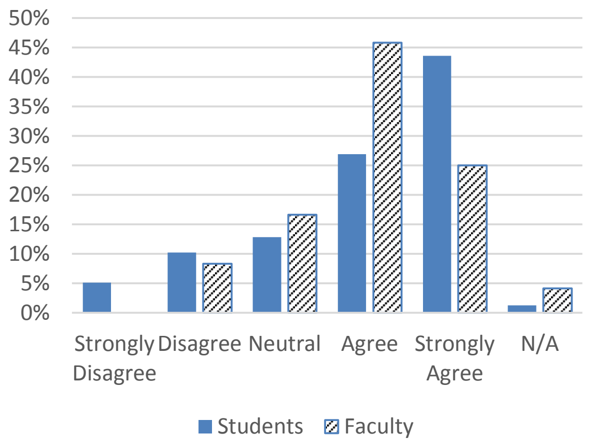

Fig. 5 It was easy for me to interact with the professor/students in the class."

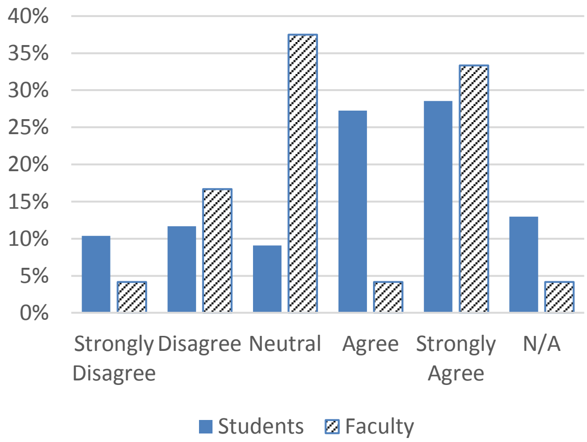

Fig. 6 "The technology was not a barrier for me to teach/learn the content of this course."