



The Converged Classroom

Prof. Gregory L. Wiles P.E., Southern Polytechnic State University

An assistant professor of industrial engineering technology at Southern Polytechnic State University, a four-year technical university in Georgia. He has a BS degree in Industrial Engineering at the University of Tennessee, an MS degree in Industrial & Systems Engineering at the Georgia Institute of Technology, and currently working on his PhD. Prior to teaching, he worked for Lockheed Martin, Union Carbide, nVision Global, Oracle, and Georgia Tech in various engineering roles from research, to technical sales, to division management.

Mr. Thomas Reid Ball, Southern Polytechnic State University (ENG)

Thomas R. Ball joined Southern Polytechnic State University's Industrial Engineering Technology Department in 2004 and currently serves as the Department Chair. Before joining SPSU, Professor Ball held senior-level management positions throughout much of his 30-year career in manufacturing, operations and distribution. He has served as chair of the American Apparel Manufacturers Association's Apparel Research Committee, and is a member of the Southern Chapter of the International Association of Clothing Designers and Executives. Professor Ball also holds the position of W. Clair Harris Endowed Chair. His academic background includes an Associate of Science degree from Southern Polytechnic, BA from Oglethorpe University and an MBA from Georgia State University.

The Converged Classroom

Abstract

The growing need to work smarter in teaching classes plus effective utilization of classroom space gives way to a rethinking of how classrooms should be structured to accommodate today's students. One engineering department at Southern Polytechnic State University, a 4-year technology-based university, stepped up to the challenge of developing and offering a converged online and face-to-face (f2f) interactive learning environment. The uniqueness of this converged learning environment is our ability to offer multiple delivery modalities simultaneously as one single classroom. Students have a choice of attending as a distance learner (online), or as a hybrid learner (both f2f and online). The lecture meetings are recorded for later playback in case students are unable to attend. The virtual attendee and the physical attendee become harmonious with the added ability to freely switch among modalities from week to week. This unified yet flexible environment goes beyond the need to accommodate job and family commitments; it also serves to provide consistent course content, to promote more student interaction, and support their various learning styles. Benefits to the school are better utilization of space, increased enrollment, better utilization of faculty, and promotes student retention. This engineering technology department continues to improve the environment with more efficient use of learning management technology and working with the school administration for adaptations in the areas of course registration, tuition costs, and information technology.

The evolution of the converged classroom

This new environment was developed over a period of 3 years migrating from a traditional f2f classroom into hybrid and online environments. The need to evolve culminated from changes in the type of students enrolling in our classrooms. The growing need to accommodate non-traditional students who have full-time jobs, part-time jobs, perhaps older than your traditional college student, with life-changing events such as getting married, starting a career, or starting a family, spawned our need to make course delivery changes. Theorist Malcolm Knowles¹ discussed andragogical learning theory and how institutions who teach adults can adapt their teaching habits within the learning environment. Knowles' concept of andragogy has been widely adopted by educators from various disciplines around the world. Andragogy is based upon six assumptions: (a) self-directedness, (b) need to know, (c) use of experience in learning, (d) readiness to learn, (e) orientation to learning, and (f) internal motivation. Satisfying adult learners includes providing class flexibility as well as accommodating their learning style needs. The evolution of today's classroom, as described here, is nothing new; many other colleges are going through similar growing pains and having to learn ways of utilizing new technology-based tools².

Back in 2009, we recognized the need to adapt our course delivery types or modalities to fit the needs of both traditional and nontraditional students. This produced a need to evolve the course modalities to react to the changes to the type of students enrolling in our classrooms. Research showed that pursuing a hybrid or a blended learning environment is an improvement over the traditional or campus classroom³. One study showed that students even preferred a hybrid course over the old traditional classroom⁴. Our quasi-study supports this.

The description of the traditional classroom for this department is a twice-a-week class consisting of 75 minutes of f2f per class period. The instructor conducts the class in a traditional manner with transparency projectors or perhaps with the help of technology such as a computer/projector and PowerPoint slides combination. Homework and tests are typically given and received through paper handouts and take ups. Our plans were to migrate toward a hybrid learning environment, also called blended learning and the terms can be considered interchangeable^{5,6}. The concept is similar for both hybrid and blended where there is a combination of traditional f2f classrooms with an addition of a web-based digital content delivery system⁷. For this engineering department hybrid classes are designed to meet once per week for 75 minutes in an f2f tradition (synchronous) with the remainder of the week (another 75 minutes) spent primarily with pre-recorded streaming video lectures (asynchronous). Additional time is spent on accessing other course materials such as printable lecture notes, PowerPoint slides, homework assignments, or uploading completed homework. Students are expected to be self-disciplined enough to keep up with the material in preparation for next week's f2f classroom meeting. The instructors provide a fifteen week semester schedule readily downloadable that describes the weekly course requirements along with deadline dates. Since 2004, we have run a successful graduate level degree program entirely online thus we were able to take lessons learned from that experience and parlay that into undergraduate classes taking a midway approach with hybrid solutions rather than jumping immediately to fully online solutions. We have seen a measurable effect of students preferring hybrid classes over traditional and online classes. Figure 1 demonstrates the results of a longitudinal quasi-experiment of enrollment data over the past 7 semesters representing a total of 3,707 enrollments in IET undergraduate classes. The chart shows a marked decrease in traditional class enrollments, a marked increase in hybrid class enrollments, and a slight increase in online enrollments. As enrollment continued in the now popular hybrid and online classes, the traditional offerings were gradually reduced.

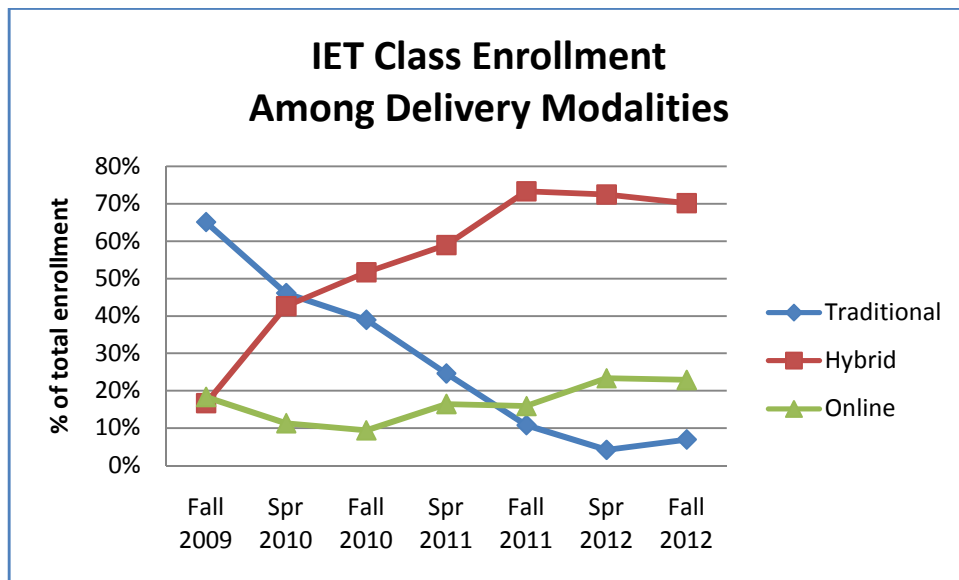


Figure 1: Comparison of undergraduate IET course enrollments by modality.

Maintaining a quality offering

A concern that could not be ignored was to maintain our quality level of learning outcomes. We were very mindful during the development of these courses that we assure the quality of the learning outcomes, the rigor, the assessment criteria, and other course requirements due to new delivery methods. With this in mind, a short pilot study was conducted by one instructor for one course. This was a sophomore level statistics course offered in three modes: traditional, hybrid, and online. The results of the study showed a statistical significance of the three course delivery methods lending credence to the delivery method's effect on student performance. Also the study showed that the traditional setting outperformed overall on average over the hybrid and online settings but non-significant in isolated categories such as homework assignments⁸. These findings could be due to the low sample size used as well as the level of self-discipline required among the sophomores or due to the novelty of hybrid and online offerings back in 2009. In the student satisfaction category it was shown that students were generally pleased and adapted well within the modality they chose^{7;8}. In studies regarding the preservation of learning outcome effectiveness between a traditional and a hybrid learning environment, there was a marked increase observed on learning outcomes as perceived by the students⁹ and evidence of higher cognitive learning with hybrid and online students¹⁰ and there was found to be no significant differences in learning outcomes between hybrid and online classes¹¹. Aside from the technology learning curve, it is expressed that the bottom line for educators is that the traditional effectiveness and efficiency of learning outcomes are preserved under both hybrid and online learning environments¹². When learning styles were examined by Choi, Lee, & Kang¹³, they discovered that it was more efficient to encourage students to adapt to a hybrid or online learning environment than to design adaptive systems to accommodate student's diverse learning styles.

Our own quasi-study yielded the results seen in Figure 2. This figure demonstrates course assessments from the last 7 semesters of 230 completed undergraduate IET courses. At first there was a divergence seen as a percentage of students receiving a C or better letter grade among the traditional, hybrid, and online courses. In the fall of 2009, when the program began, students scored 6% higher in hybrid courses over traditional courses and 18% lower in online courses over traditional courses for a range of 24%. By the fall of 2012, a gradual convergence is seen where the range is currently within 5%. This indicates that learning outcomes as measured by student performances in the three modalities is becoming undistinguishable thereby preserving quality.

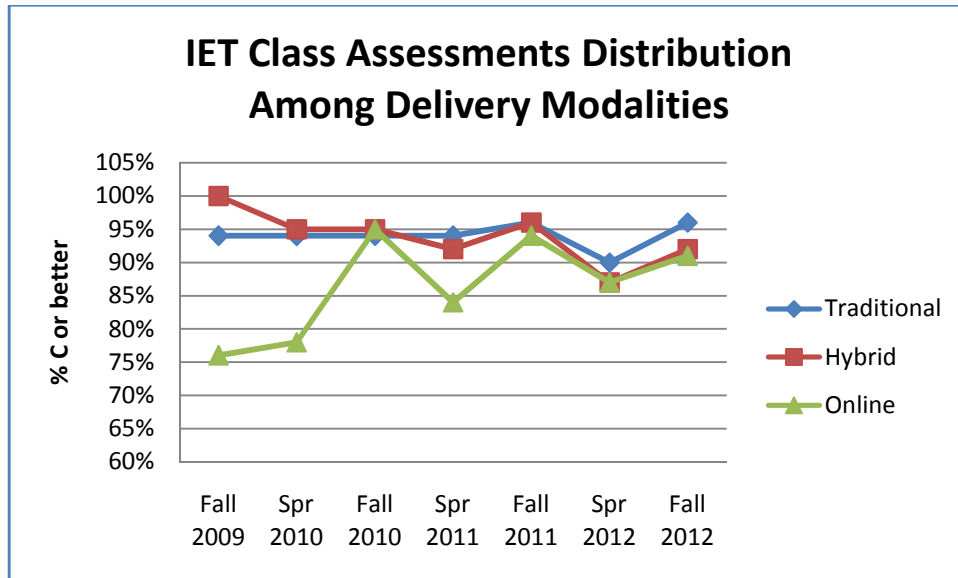


Figure 2: Comparison of undergraduate IET course assessments (final letter grades) by modality.

The journey toward the converged modality

The term “converged classroom” adequately describes the true dynamics of this delivery and learning environment. The initial migration was to adapt our traditional courses toward a digitally and web-based hybrid environment managed by our learning management system (LMS) sometimes referred to as a course management system. This required instructors to attend training classes to learn how to build their course within the LMS which was Blackboard Vista at the time (later changed to Desire2Learn). The course development for online use on the LMS was assessed by our internal instructional design group as well as an external assessor (which excluded course content). This platform allowed instructors to design the interface, upload course material, develop and link to pre-recorded lectures (through Echo360 Personal Capture, Ensemble, or Camtasia), and provide means to download material by the students during each school week. By spring of 2010 there were 13 hybrid courses offered out of 23 after instructors were trained and their courses transposed. As these courses were migrated and taught, soon we realized that this was a perfect foundation for synchronous online course delivery by adding one additional piece of technology; a real-time video exchange software application such as Wimba Live Classroom (and later GoToTraining). In this capacity the instructor is available to lead the course in live lectures and also through downloadable material, emails, texts, discussion areas, groups, and assessments through online exams and homework drop boxes.

For our department, we deliberately intended our online courses to be instructor-led, primarily synchronous, and secondarily asynchronous. The reason is to preserve instructor interaction with the online students (resembling a traditional classroom) with real-time dialog and secondly allowing the review of past archived lectures. The steady conversion and offering of our engineering classes to hybrid and online and the actual delivery of the courses gave faculty more practice with the technology and thus more confidence to proceed. Each modality was given its

own course section number and during each semester's registration period (perhaps months ahead of time), students are asked to make a decision between traditional and hybrid courses. At first, marketing the difference between hybrid and traditional offerings via mass emails and brochures was still a bit challenging. This attempt usually followed with emails and telephone inquiries from students asking for clarification. The registration process was closely watched by the department chair and the department administrative assistant and determined, once understanding the difference; hybrid classes were becoming more popular over traditional classes. The advantage students quickly realized was the obvious need to only attend class once a week instead of twice a week. For on-campus students it saved an extra walk from their dorm, and for off-campus commuter students it simply meant one less day with traffic and an opportunity to save on high gasoline costs.

This department understood the value of a hybrid setting and began to develop and offer online classes as a synchronous environment. The only difference was the inclusion of Wimba Live Classroom software so that real-time communication with the students was possible. This opened possibilities of existing and prospective distance students a way to attend class remotely. It is not unusual to have students attend class who live as far away as China (a 12 hour difference) or a traditional on-campus student who occasionally prefers the advantage of attending class from their dorm room. As stated before, during the registration period students were asked to decide between traditional (2 special purpose and capstone classes), hybrid (28 technical classes and labs), and online classes (30 technical classes and labs) each denoted by a different section number. Many of these classes among the three modalities were being taught by the same instructor, so it soon became apparent after a constant feeling of redundancy some of these classes can be *converged*. In 2011 we began combining the hybrid and online classes at the same time and thus the converged classroom was born. Students now review the Schedule of Classes from the school website and discover, for instance, course IET3424-850 offered next semester on Tuesdays at 1:00 pm with a section designation of -850 meaning this is a hybrid class. Section numbers of -900 represents an online course offered at the same time (Tuesdays at 1:00 pm). This simultaneous offering provides a dual platform for the instructor to teach the class in one time slot for two sets of students, one set is f2f and the other set is virtually attending via Wimba Live Classroom. This is the general configuration of the converged classroom.

In order to make this work successfully, the technology within the classroom needed to be upgraded. This was accomplished by providing tools designed to transfer information (both visual and audio) digitally. First, for the visual portion, a dependable interactive writing (pen or stylus) system was needed at the instructor's lectern to replace the whiteboard. We chose an all-in-one Symposium/SmartBoard with a 19" display especially designed for stylus writing. The display can also be tilted at an angle for a comfortable writing position. For the audio portion, special wide-area microphones with a separate microphone at the instructor's lectern were installed to capture the hybrid student's and instructor's voices. Online students were encouraged to obtain headphones with microphones to participate verbally with students in the classroom but also have the option to forego and chat (text) instead. Ceiling speakers were installed to relay voices from the online students who use microphones. At the beginning of a lecture, the LMS is activated by the instructor at the lectern with a link to Wimba Live Classroom. The entire desktop is then shared and made visible to the hybrid students via a projector/screen and visible to the online students through Wimba. Any documents,

PowerPoints, or other web sites accessed are readily viewed by all students. The archive capability within Wimba captures and records both the visual and audio portions of the lecture for later viewing or reviewing.

This technical setting, thanks to the support of our IT department, distance learning, and our instructional design group, allowed a joint membership of both sets of students into one converged learning environment. Many times discussions or project presentations take place between hybrid students and online students, each hearing and responding to each other in real-time. For the two sets of students, the one class time with the live instructor is still 75 minutes long and both sets of students are on their own to cover any remaining material (the second 75 minutes) throughout the rest of the week with the convenience of 24/7 access. Through the LMS, the instructor can monitor student activity, participation, and attendance requirements through the software's reporting capability. Studies support this need for instructor-student and student-student interaction to help overcome academic isolation, social isolation, and a sense of disconnection common with pure online classes ^{14; 15}.

Further adaptations of the converged environment

To prevent the repetition of the same course listed twice in the LMS (once as an -850 section and another as a -900 section) a "cross-listing" technique was adapted to combine the students from both sections into one class section within the LMS using the designation "XLS" to represent a cross-listed section. This is working well within the LMS system because the instructor only has to edit and monitor only one LMS course website for two sets of students. The reason behind cross-listing is twofold; one is to relieve the instructor of dual work, and the other is to maintain a consistency and quality of the course material. Each set of students receives the same material and instruction with no omissions or errors due to maintaining dual web course sites. While this cross-listing approach is working well, a side-effect is a loss of distinction among hybrid and online students, or a blurred dividing line. Hybrid students now have access to the Wimba Live Classroom as well as the Wimba "archives" or past recordings of live lectures. The archives were originally designed for the online students should they miss a live session due to their work schedule, sick child, or for a multitude of other reasons. Since hybrid students have the same access they are very astute and learn quickly to access the archives as well. Sometimes instructors receive emails from hybrid students providing reasons why they can't attend class and ask permission to watch the archive. Often granted, so as not to deny course progress, the student watches the archive to keep up with the class.

When converged classes and cross-listings are engaged simultaneously, there is still a purposeful separation of the hybrid students from the online students. The reason for this division is due to extra tuition costs for online classes during enrollment to help pay for the technology costs involved with online teaching. Keeping a separation of the two sets of students becomes increasingly difficult but it is our observation that students are actively switching between the hybrid and online learning environments at will. Occasionally we would observe a hybrid student logged onto Wimba Live Classroom and conversely observe online students sitting in class.

Our goal

The goal for this department is to see a combination of the course sections into one and achieve one equitable tuition cost among both the online and hybrid courses. Upon this occurrence, students will receive a greater flexibility for their time schedule as well as their learning styles and be awarded the freedom to choose whether they wish to sit in class (for those who can) with the instructor that week or switch to be an online student that week. We feel that this dynamic choice relieves the student of having to choose their delivery method months ahead each semester and provide students a way to cope with life's interruptions while being confident of an existing alternative. We also suspect that the converged classroom helps promote student retention and graduation rates but a future study will be needed to validate this suspicion. Informally, however, we have gathered some first-hand case testimonies that could positively affect retention and graduation rates.

1. Two campus students could not complete the semester, one due to a vehicular accident and the other due to a temporary debilitating illness were given incompletes (I). The students were later permitted access to the recorded archives for the specific classes missed and both successfully completed the remaining course requirements for credit.
2. A student was forced to spend four hours per day commuting to and from campus classes due to the multi-county bus schedule. The quality of life for this student was greatly enhanced with the offer of online and hybrid formats.
3. A student was unable to complete her last four courses toward graduation due to her spouse being transferred out of state with no local university to transfer credits. She was able to complete her last four courses online to graduate.
4. More than one student has continued or completed their education while serving in the military (even stationed overseas).
5. Several students who due to life changing events could not continue their educational goals as full-time students and completed those goals part-time due to the online format.
6. Another group of students withdrew before completing their degree and joined the workforce. Several have since returned to school due to the flexible converged format.
7. Student comment 1: "The pre-recorded lectures and archived live sessions allow me to review the material until I got it which has been a tremendous asset for me."
8. Student comment 2: "I was nervous about taking online courses. Now that I have taken 4 or 5 with the live sessions, I don't care to ever take another classroom course. The flexibility works well with my family and work responsibilities."

Benefits and disbenefits of the converged classroom

Offering a modality choice to students provides flexibility and convenience of taking classes while dealing with other issues that may arise. Also by offering this dynamic choice of hybrid or blended learning environment, more opportunities are made available to more students. Studies have shown that hybrid interaction between the instructor-student and student-student promotes an increased opportunity for students to lend their opinions, an increase in personal motivation, and a positive reinforcement of learning¹⁶. While being a good pedagogical/andragogical tool for reaching out to all types of students, online and hybrid teaching can improve class participation and attendance, develop group identity, and provide efficiency of instruction with

dependencies on how the actual mix of f2f and online components are met¹⁷. Another benefit of combining sections is to avoid course section cancelations due to low enrollment numbers. As for the disadvantages, this includes an increased workload initially by faculty, cultural and technical barriers, the interdependencies of working in dual environments, and the increased need for student self-discipline¹⁶.

Conclusion and closing remarks

In the spring of 2013 our department offered 19 undergraduate technical courses, 100% in the converged format. In the converged learning environment, the two simultaneous sets of students interact with each other through audio/video technology, email, and text messaging. The age of the pure traditional classroom setting is slowly yielding itself to the converged learning environment with accompanying technology tools to make this all possible. This unified approach provides the need to satisfy one's learning style and goes beyond to accommodate job and family commitments with the potential to promote student retention. The benefits are not just student-centered, the faculty and the school also benefit through a more efficient use of the faculty's time, a better utilization of classroom space, an increase in enrollment, the need to address student retention and graduation rates. The industrial engineering technology department will continue to improve this process with more efficient use of the LMS and working more closely with the school administration to adapt course registration, tuition costs, and information technology to the converged format. Clearly thus far, the advantages of a converged classroom have far outweighed the disadvantages from class observations and personal student comments. Our approach of the converged learning environment will likely continue with the continued support of institution administrators for future adaptations and changes to continuously improve this delivery modality as we move forward.

Bibliography

1. Knowles, M. (1980). *The modern practice of adult education: From pedagogy to andragogy* (2nd ed.). New York, NY: Cambridge Books.
2. Massoud, A., Iqbal, U., & Stockley, D. (2011). Using blended learning to foster education in a contemporary classroom. *Transformative Dialogues: Teaching & Learning Journal*, 5(2), 1–11.
3. Boyle, T. (2005). A dynamic, systematic method for developing blended learning. *Education, Communication & Information*, 5(3), 221–232.
4. Bassett, E., & Gallagher, S. (2005). Students prefer hybrids to fully online courses. *Recruitment & Retention in Higher Education*, 19(8), 7–8.
5. Gecer, A., & Dag, F. (2012). A blended learning experience. *Educational Sciences: Theory & Practice*, 12(1), 438–442.
6. Musawi, A. S. A. (2011). Blended learning. *Journal of Turkish Science Education (TUSED)*, 8(2), 3–8.
7. George-Palilonis, J., & Filak, V. (2009). Blended learning in the visual communications classroom: Student reflections on a multimedia course. *Electronic Journal of e-Learning*, 7(3), 247–256.
8. Scherrer, C. R. (2011). Comparison of an introductory level undergraduate statistics course taught with traditional, hybrid, and online delivery methods. *INFORMS Trans. Ed.* 11(3) 106–110. doi 10.1287/ited.1110.0063.
9. Anwar, A. H. M. F. (2011). The use of students' feedback for effective learning in engineering units. *International Journal of Learning*, 18(4), 131–142.

10. Akyol, Z., & Garrison, D. R. (2011). Understanding cognitive presence in an online and blended community of inquiry: Assessing outcomes and processes for deep approaches to learning. *British Journal of Educational Technology*, 42(2), 233–250.
11. Doo Hun Lim, Morris, M. L., & Kupritz, V. W. (2007). Online vs. blended learning: Differences in instructional outcomes and learner satisfaction. *Journal of Asynchronous Learning Networks*, 11(2), 27–42.
12. Wong, J. J. (2006). Traditional versus hybrid courses. *International Journal of Learning*, 13(8), 163–170.
13. Choi, I., Lee, S. J., & Kang, J. (2009). Implementing a case-based e-learning environment in a lecture-oriented anesthesiology class: Do learning styles matter in complex problem solving over time? *British Journal of Educational Technology*, 40(5), 933–947.
14. Erichsen, E., & Bolliger, D. (2011). Towards understanding international graduate student isolation in traditional and online environments. *Educational Technology Research & Development*, 59(3), 309–326.
15. Willging, P. A., & Johnson, S. D. (2009). Factors that influence students' decision to drop out of online courses. *Journal of Asynchronous Learning Networks*, 13(3), 115–127.
16. Gedik, N., Kiraz, E., & Yaşar Özden, M. (2012). The optimum blend: Affordances and challenges of blended learning for students. *Turkish Online Journal of Qualitative Inquiry*, 3(3), 102–117.
17. Kurthen, H., & Smith, G. G. (2005). Hybrid online face-to-face teaching. *International Journal of Learning*, 12(5), 237–245.