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Hybrid Courses in Aeronautical Science Curriculums

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Abstract

This article focuses on the need to address learning styles of NetGeners with an emphasis on aviation students. A brief history of aviation training generations as posited by Kearns (2010) is reviewed after which the author's experience creating a university hybrid or blended course on Crew Resource Management is discussed. This article was supported in part by a grant from Embry-Riddle Aeronautical University's Center for Teaching and Learning Excellence.

Increasingly, educators are acknowledging the fact that Digital Natives or NetGeners are more attuned to learning via other than the traditional methods involving lectures and textbooks. A digital native is one born since the advent of digital technology. Today, 89 percent of 18-24 year olds are online. Individuals aged 12 through 24, spend an average of four and a half hours per day viewing screen materials (excluding games). Further, 82 percent of students in 7th through 12th grade, media multitask (Digital Nation, n.d.). Educational institutions, including colleges and universities, are slowly realizing the learning styles and educational needs of NetGeners are different. Recognizing this and meeting those needs are two quite different things. This is especially true in the area of aviation education where the Federal Aviation Administration (FAA) dictates training requirements.

Kearns (2010) has categorized aviation training into four generations. The first is that of Apprenticeship (1903-1929). From the beginning of flight, the Wright Brothers laid the foundation for aviation training. The basic format is one of classroom instruction (i.e., ground schools) and aircraft in-flight training conducted according to the apprenticeship model. That is, an experienced pilot guides a student pilot through demonstration and knowledge dissemination until the student gains a prescribed level of competency. The second generation is that of Simulation (1929-1979). With the invention of the Link trainer in 1929, flight training was no longer dependent upon actual aircraft. Simulators evolved from the rudimentary Link instrument trainer to today's high fidelity, full motion simulators. A pilot may now complete all training in a flight simulator with the first actual flight in the aircraft, in revenue service, with passengers.

Safety, the third generation, began with the National Aeronautics and Space Administration's (NASA) 1979 workshop generating the concept of cockpit resource management (CRM). Originally, only the flight crew received CRM training. Later, CRM training was expanded to include other aviation team members such as cabin crew and dispatchers and hence is now termed crew resource management (CRM). Today, CRM has evolved to include threat and error management (TEM).

Kearns (2010) has dubbed the current generation of aviation training as that of Customization. Kearns sees this generation as a major paradigm shift from standardized training to that of performance based training. The traditional training paradigm was not designed for learning but rather for sorting learners. Standardization allowed
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sorting according to minimum standards rather than learning to maximum potential. Instruction was more focused on following procedures than on decision making and problem solving. In the airline industry, this shift is reflected in Advanced Qualification Programs (AQP) (“Advanced Qualification Program, FAA AC120-54A,” 2006). In general aviation, this is reflected in the learner centered FAA-Industry Training Standards (FITS) (“FITS,” n.d.). FITS is a non-regulatory, industry driven, performance based redesign of general aviation training targeted at technologically advanced aircraft (TAA). Key elements of FITS include scenario based training (SBT) and single pilot resource management (SRM).

This paradigm shift in aviation training is important for several reasons. First, it recognized that as aircraft became more technologically sophisticated, workload often increased rather than decreased at critical times, especially for single pilot operations in congested airspace. Second, while aircraft and their systems are now more sophisticated, they are also more reliable. Most accidents are no longer attributed to mechanical or system failures but rather to a breakdown of crew resource management or human error. Indeed, between 45 and 85 percent of all accidents are directly related to human error (Shappell & Wiegmann, 2004; “Safety Standdown Brochure,” 2011). Aviation training now emphasizes the soft or nontechnical skills (NTS) such as communication, decision making, and problem solving (Filin, 2010). This is found in both the airline and general aviation environments as reflected in CRM, Line Oriented Flight Training (LOFT), FITS, and SRM training.

While the shift in the training paradigm from standardization to customization is important, it does not necessarily mean that advances in technology will be utilized to the fullest in ground school classroom settings. Modifying traditional ground schools has been a challenge. Powerpoint brought with it an opportunity for “better” use of diagrams and images and more recently, in the form of Prezi, animation and non-linear designs. Increased use of the Internet in wired classrooms has allowed the showing of videos that would have been unattainable or unthinkable just a few years ago. Even introducing innovative methods such as the “one minute paper,” gaming, simulation and team based learning has not truly revolutionized classroom learning (see for example, Serman (1992) or various “Harvard Business Cases” (n.d.)). Flight simulation technology, on the other hand, has advanced at a much faster pace, assisted largely by advances in gaming technology (for example, see the most recent proceedings of the Society of Applied Learning Technology, 2012).

In the age of NetGeners and digital technology, aviation programs need to reflect (lead?) the industry in innovative class techniques. Embry Riddle Aeronautical University (ERAU) Worldwide has long been a leader in delivering asynchronous online learning to students around the globe. Like other brick and mortar institutions (Hundley & Worley, 2011), the residential campuses of Embry Riddle have been somewhat slower to test the waters of online and hybrid delivery. In the past two years, the Daytona Beach campus of ERAU has been supporting an initiative to increase delivery of hybrid or blended courses. The support has come from the highest levels and is demonstrated in several ways. First and foremost, is support from the University President to Department Chairs. Second, maintaining technologically sophisticated classrooms and encouraging the use of emerging technology such as smart tablets, iPads, and other digital media. Third, Embry Riddle’s Center for Teaching and Learning Excellence (CTLE) has been providing training, support and grants to faculty willing to create hybrid courses. And most recently, ERAU has created an Educational Technology department along with outlining an Educational Technology strategic plan.

As a first step to integrating hybrid courses into the Aeronautical Science curriculum, the author applied for and received a grant from ERAU’s CTLE. In addition to the grant, CTLE provided support for the course development in the form of ongoing seminars dealing with the creation of online content, appropriate pedagogy and critically important, instructional design assistance and technological support (Smith, 2008).

One of the most critical aspects of creating hybrid courses is determining which courses are appropriate for hybrid delivery. Hybrid (or blended) courses are a combination of face to face (F2F) and online delivery (Valathan, 2002). One of the major advantages of the online portion of a hybrid course is the use of digital media, reaching NexGeners and those with learning styles other than the usual auditory focus of F2F classrooms. One obvious limiting factor in aviation is the FAA’s mandate for classroom instruction. Therefore, traditional ground schools such as private, commercial, and instrument pilot operations were not even considered at this time. Rather, the author, an experienced CRM instructor, elected to redesign AS387, Crew Resource Management, for hybrid delivery.

While recent academic literature is somewhat positive on the appropriateness of crew resource management for online or hybrid development (Kearns,
the aviation industry has often considered it inappropriate. One must remember, however, that industry CRM training is focused on simulator training utilizing LOFTs, the skill sets involved, and requires actual practice of crew resource management. Traditional academic courses on CRM are usually focused on the historical development and theory of CRM rather than the application of CRM. Such is the nature of AS387 CRM at Embry Riddle. The F2F course teaches the historical development of CRM, the critical nontechnical skills involved, accident analysis and discussion. The F2F course makes extensive use of videos, discussion, simulations, exercises and crew presentations—very much a seminar rather than a lecture format. Nonetheless, its format is geared primarily to auditory rather than visual and tactile learners. Given research showing that approximately 44 percent of pilots are tactile learners, the F2F course would be challenging for a good many students (Raisinghani, M.S., Chowdhury, M., Colquitt, C., Reyes, P.M., Bonakdar, N., Ray, J., 2005).

Additional support for CRM as an appropriate subject for hybrid course development comes from other critical and high reliability areas such as medicine, the armed forces and aviation weather operations (“Army Trends,” 2011; Bryce, E., Chi, P., Landstrom, M, LoChang, J., 2008; Nullmeyer, et al., 2007; Dulong, T.W., Witsaman, P.G., Johnson, V.C., and Wesley, D.A., 2008). Indeed, the Australian Civil Aviation Safety Authority has created a twelve part safety video on CRM (“CRM Safety Video,” n.d.).

AS387, Crew Resource Management, is required of all Aeronautical Science majors at the Daytona Beach campus. The F2F course is limited in size to 18 students per class to foster teamwork and maintain a manageable size given the current course format. This limit was retained for the hybrid version. The F2F course is offered on either a Monday, Wednesday, Friday schedule for one hour each day or a Tuesday, Thursday schedule for one hour and fifteen minutes each day. After reexamining the course content, the decision was made to have one-third of the content online. From an initial development strategy, this fit best with a Monday, Wednesday, Friday schedule. To maintain consistency and ease of scheduling for the students, Fridays were selected as the day to be replaced with online content. This accomplished several things. First, by being the same day every week, the students (and instructor) could easily keep track of which day not to come to the classroom. The instructor was still available for student consultation during the regularly scheduled class time. Second, this allowed maximum flexibility for the students, with all assigned work to be completed and posted no later than 0600 local time, the following Monday. Last, by having one third of the class online, maximum efficacy of the F2F time was maintained.

From an instructor’s viewpoint, two of the most challenging aspects of developing a hybrid course are the time required to create the course and the technical knowledge required. This course was no different. Initial development was completed during one semester. A key element in the transition from F2F format to hybrid was determining how to arrange the F2F and online portions of the course, which topics would best lend themselves to online delivery, and how to deliver and assess the online portion. As this was the first aeronautical science course to be delivered in the hybrid format, an ancillary issue was student receptiveness and acceptance of the hybrid format.

As part of the CTLG grant, the instructor had the assistance of an instructional designer conversant with online course development. This was of immeasurable value and definitely led a more robust development of the course. AS387 was developed online using the Learning Management System BlackBoard (“BlackBoard,” ad.) as well as several other online resources such as Animoto (“Animoto,” n.d.). and Voki (“Voki,” n.d.). One does not have to take the full plunge and place as large a portion of one’s course to the online realm as was done here; utilize online technology for what makes sense in your course.

ERAU’s semester is fifteen weeks long. Three weeks were reserved for student presentations and course wrap up while the first week contained a separate “Start Here” section. This section contained materials critical to a student’s success in the hybrid course, including the syllabus, tasks to be accomplished and due dates, a PowerPoint and video presentation on hybrid courses, grading rubrics, and student responsibilities. The rest of the online content was divided into ten modules, one for each major topic in the course.

Internal ERAU research and student feedback has shown that the most challenging aspects of an online or hybrid course are motivation and discipline. To this end, the online section consisted of various materials and assignments designed to reach various learner styles. A high use of online content such as videos, interactive web sites and teamwork was deemed mandatory. Students appeared excited about the use of technology in this manner as evidenced by response rates to an informal survey given to the inaugural classes and as shown by an ERAU campus wide survey.
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Where early training videos on CRM were often proprietary, YouTube is populated with excellent and recent videos on major accidents involving CRM and other pertinent videos such as segments by Professor Dekker of Lund University on developing a just culture (Dekker, n.d.). These appeal to visual learners, are more relevant than archaic film footage, and allow students to watch the videos as often as they need. The hybrid format allowed students to note key elements and think critically about the videos rather than only seeing them once in class. Students were required to brief each video and then discuss it in the F2F class setting. Limited use was made of discussion boards. The discussion boards were primarily used for posting briefings and video segments made by students. F2F time was reserved for crew interactions, exercises, discussions, and presentations.

The online modules also contained reading assignments (FAA Advisory Circulars, e-texts, and academic articles). These materials were assigned to rotating crews for reading and briefing. This was done for two reasons: first, all students were paired at one time or another, maximizing exposure to many learning styles and personalities. ERAU has an extremely diverse aeronautical science student population consisting of international students, returning veterans, traditional age college students, minorities, and women. This rotating crew pairing reinforced the need to cooperate and utilize the non-technical skills learned. “Fixed” pairings were used for the exam and major projects in the course: crew led guided discussions on a CRM topic and presentations of a critical analysis of an accident involving CRM.

There was one exam at midterm to assess the student’s mastery of key CRM concepts. This was completed as a fixed crew, online, using a wiki in BlackBoard. A wiki format was chosen for several reasons. First and foremost, the crew sinks or swims as a crew, as in the real world. Second, the use of a wiki on BlackBoard allowed the instructor to track individual contributions, word counts and timelines. Both qualitative and quantitative assessment was possible. Feedback from students was quite positive in regards to ease of use, the quality of the exam answers generated, and crew participation; flexibility was a key aspect for them.

As with traditionally delivered F2F courses, a hybrid course requires continual improvement and updating. As noted previously, most of the development work was completed before the class began. In addition to maintaining subject matter expertise, a key facet of hybrid course development is staying abreast of current and new emerging technologies and online resources. It is also essential to maintain links for online materials and to communicate with the students. Learning management systems make this fairly easy. Modifications are made each semester to take advantage of new technology (e.g., iPads) and web sites as well as to adopt new content. As with traditional classes, not everything works as planned; flexibility and experimentation are the keys to successful hybrid course delivery.

Student participation in hybrid courses at ERAU’s Daytona Beach campus has been small but is growing. An informal goal is to eventually have ten percent of the courses offered in a hybrid format. This will obviously vary by department and appropriateness of the subject matter. Even in a department with mandated FAA courses (i.e., ground schools), there are innumerable other courses amenable to the hybrid format.

To date, three sections of AS387 have been taught over a two semester period. While initial enrollments have been small, a couple of common themes have emerged. The first semester the hybrid version was offered, many students took the class because it was offered at the right time; they had little knowledge or experience with online or hybrid courses. The second semester, almost all students took the hybrid version because it was a hybrid version. Increasingly, students are familiar with and want online or hybrid courses, often taking them early on in their educational career at the secondary level. Technology does not frighten today’s students; rather, the use of technology excites them. Remember, they are digital natives. This does not always translate into being a sophisticated user but they are definitely comfortable with technology and are quite willing to explore new digital venues.

Some students thought there would be more work with a hybrid course. In redesigning the course, a concerted effort was made to keep the online portion manageable. It is often tempting to add more material because it is available online but remember, an online module simply replaces class and student preparation time. For AS387, that meant one hour of F2F time and two hours of student preparation time. Students in AS387 thought group work was easier to accomplish with the online facilities available and liked the use of wikis. Critically, students thought they learned more than in a F2F only class.

This hybrid version is being modified for future delivery on a Tuesday/Thursday schedule as well as during
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a four week study abroad program. Student feedback and faculty input are essential for developing, maintaining and improving courses. This is especially true with a new format such as blended or hybrid courses. Assessment to date has been mostly qualitative in nature (student perceptions) although overall, students in the hybrid section have earned grades as good as or better than students in the traditional F2F sections. And while empirical assessment of the hybrid course has yet to be done, initial qualitative evidence suggests that perhaps this is, indeed, the best of both worlds.

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