NARROWING THE DISTANCE
Implementing a Hybrid Learning Model for Information Security Education

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Distance education has become an expectation with students who have grown up with technology as well as nontraditional and working students. Most universities now offer a wide range of online courses and degree programs to meet these needs. Online delivery of technology courses, however, has been problematic when the course includes very complex topics or hands-on components. An alternative presentation mode is the hybrid, or blended, model where class meetings alternate between physical face-to-face sessions and online activity component. This article discusses faculty preparation, as well as the benefits, challenges, and outcomes of using the hybrid model for a security course over a 2-year period.

While distance education methodologies have been widely adopted in certain disciplines, online approaches have been less popular for technical programs such as information systems (IS). Computer and network security courses in the IS curriculum represent particular challenges. Business concepts such as policy, risk tolerance, and disaster recovery must first be mastered, then implemented through the use of technical solutions. The technical tools used to defend networks are the same tools used by outsiders trying to illegally penetrate network perimeters. These topics and tools must be carefully introduced, along with the ethical implications of inappropriate use.

The networking and telecommunications major at Boise State University is designed to produce graduates who enter the workforce with practical skills as well as an understanding of how technology solves business problems. Hands-on labs are an important mechanism to build these skill sets, and would appear to make traditional classroom learning the only viable option. However, as Applegate (2002) noted in a Harvard Business School symposium on adult learning, it is time to better utilize the technology component, and
“think differently about how we think about learning.” This paper looks at a 2-year experiment in teaching a technical security course in a hybrid format.

THE HYBRID MODEL OPTION

The hybrid or blended model is thought to be the one of the most effective new education strategies (Skill & Young, 2002). The hybrid model improves upon distance education formats by supplementing online methods with face-to-face interaction between students and faculty. Hybrid formats prepare students for in class learning through carefully designed online activities such as simulations. Student groups formed in person seem to interact more effectively during their online communication sessions. Additionally, fewer physical meetings represent less travel time for commuting students and an attractive alternative for non-traditional or working students.

Achieving Balance and Harmony Through Design

While the concept of dividing a traditional course into classroom and online components might sound simplistic, even experienced professors struggle with the question of creating balance and harmony between the two formats. Osguthorpe and Graham (2003) point out that blended (their preferred label) courses should be designed with specific purposes, and that those purposes may differ from one course to another. They recommend designing the hybrid course with six goals in mind:

1. Pedagogical richness—methods supported by theory
2. Access to knowledge—taking advantage of media-rich materials
3. Social interaction—student to student communication
4. Personal agency—student control of the learning process
5. Cost effectiveness—wise investment in professor time
6. Ease of revision—a vital concern for rapidly changing technical content. (Osguthorpe & Graham, 2003)

These goals can be challenging to someone developing an online course for the first time. While research and theory about distance learning is growing, conflicting results are often reported about the quality of learning outcomes. An abundance of software tools is available to develop media-rich learning material, but a single most effective format has not been established. Not all course topics lend themselves to online discussion as a means of developing social interaction, and not enough communication can lead to problems with student disengagement. Students desire flexibility and control over their learning environment, but not all have the level of motivation and time management skills to be successful. Anecdotal evidence gathered at the University of Southern Indiana also indicates that hybrid courses can result in more work for the student in keeping up with scheduled activities, and more coaching from the professor to prevent confusion (Reasons, 2004). The upfront development time for online courses is extensive and careful topic and activity selection is necessary to maximize the return on this time investment. Finally, it is a given that owners of technical courses will be doing continual content updates as the topics change.

IMPLEMENTING THE HYBRID MODEL FOR A SECURITY COURSE

The course discussed in this paper is an upper division elective and was developed and offered for the first time in traditional mode in the fall of 2003. Later that year, the author was one of a group of 25 faculty at our university who received a grant to explore the hybrid method and redesign a selected course. The course was offered as a hybrid in the fall semesters of 2004 and 2005. The following
sections of this article describe lessons learned in a faculty hybrid development seminar, and discuss design issues, module development, and student outcomes and reactions to the hybrid learning model. The paper concludes by summarizing building blocks to successfully implement the hybrid learning model.

Faculty Preparation

During the spring of 2004, the author participated in a hybrid seminar, attending four half-day work sessions and participating in an online environment between meetings. Live sessions included briefings on interactive learning pedagogy, designing course objectives, and measuring discussion activity. The online component of the hybrid seminar included background readings, course development guidelines, and samples of content presented using different media tools. Faculty members were assigned to online groups that were scheduled to meet online and in person to discuss choices and challenges with their course development.

The seminar leaders emphasized from the start that developing an effective hybrid course involves more than taking traditional course content and placing it online. Starting with the look and feel of the course site, we learned quickly that the interface design must be simple, with logical menu labels and navigation path. It is difficult to find content if the site’s hierarchical layers become too complex, or if material is linked only to a specific assignment.

Meaningful online discussion activities that contribute to learning and engage students help achieve social interaction, but are often difficult to develop. Students are quick to judge activities as busy work if they do not clearly see a benefit. We were also warned about finding the right level of professor participation in online discussion activities. Experienced professors noted that if they posted a response to a discussion comment, the result was either a quick closure to the discussion activity or a mad dash to agree. It is better to ask a leading question to help students focus on a desired outcome, rather than post a specific statement that might shut down the discussion or intimidate students.

The physical process of course redesign continued into the first 6 weeks of summer. Working with our instructional design consultants, we set individual milestones, attended regular meetings, and participated in show-and-tell sessions with a small peer group. Early in our seminar the leaders emphasized the importance of having the entire course mapped out before the start of the semester. While this is a considerable upfront effort, it creates an initial structure that allows for fine-tuning and flexibility during the semester. The use of storyboarding to lay out the flow of the course and distribute activities is recommended by Eneman (2005) as a mechanism to see how the course flows and significantly reduce effort in creating the course. The need for planning is foremost throughout the distance education literature.

The benefits of participating in a hybrid course before developing one cannot be overstated. Even having an existing hybrid course with guest access would help faculty see and experience the student’s view of the online world, and share their frustrations and challenges. Participation emphasizes all the things that can go wrong, and how apparently clear communication can still be misunderstood. At a minimum, anyone who implements a distance course should request a separate login with student level permissions to see the site from the user perspective.

The Security Course Redesign Process

A challenge in any course redesign is narrowing a wide range of topics to those that can be adequately covered in a standard course timeframe. The goal of the security course is to instill a solid understanding of security problems from a business perspective. Students are challenged to understand business needs, develop and interpret security policy, and understand business risk before implementing cost-effective technical solutions. The course briefly reviews and expands on the basic tech-
ologies students are exposed to in their introductory networking courses, then explores the causes, effects, and solutions to typical security threats to network infrastructures, databases, and applications. This material seemed to fall naturally into modules that allowed common material to be grouped together. In-class sessions targeted more technical content and included outside speakers, demonstrations, and hands-on labs to reinforce key concepts and teach specific software tools. Online materials were those of a more conceptual nature, or emphasized best practices in the security field along with lab preparation.

User interface design is an important aspect of any systems development project. The default Blackboard menu includes a long list of menu choices with several redundancies, such as items that appear separately and again under the “Communications” category. While “Course Materials” and “Course Documents” might be clearly differentiated in the professor’s mind, a student could easily be confused on what is available in each area. Keeping the menu short and simple is important, and fortunately Blackboard makes it easy to turn off its many options and produce a clean and user-friendly interface. Navigation links should be limited to areas students need to access most often. This approach reduces cognitive overload and frustration in having to hunt for materials.

Additionally, the three-click rule of good Web interface design specifies that users should be able to get anywhere they need to go in just three mouse clicks. Fewer navigation choices make this goal easier to accomplish. An optimal solution is to have all reading materials available from a central resource folder, as well as linked from the assignments. In this manner, the student can return to a needed document later in the course without an extensive search.

**Modular Structure and Flow**

The module format is recommended for several reasons. First, it is an organizational method to group content and supporting activities. It is also more realistic to plan and release single stable modules, rather than post a complete semester of activities that will require later changes. Second, the module is an abbreviated picture of course content that allows students to see the immediate focus and direction without overwhelming them with an entire schedule of detailed topics and activities.

Table 1 is an overview of in-class and online topics with examples of typical activities. Live meetings also began with review questions on the prior online material to assure understanding of difficult topics and gauge individual learning.

Writing concise yet complete instructions and making them easy to find is critical, and is a talent that develops with practice. The course schedule page listed an overview of the full semester with few details, and sections defining the modules. Each schedule section was linked to individual modules that included learning objectives, readings, and detailed assignment instructions. The links were not live until module activities were firm. Instructions for activities were repeated in the Blackboard “Assignments” area where homework files were posted for the students to download, complete, and return. The goal was to minimize the need to search for instructions by allowing students to retrieve them from several sources. While simplifying life for the student, maintaining multiple instruction sets can easily become a problem for the professor if changes need to be made.

The same media richness that makes the online world interesting can also lead to overuse, consuming both professor resources for development, and student resources to download and view them. Hybrid courses can readily grow to become a “class and a half” worth of content that leaves the student overwhelmed and unclear about focus.

Learning objectives were assessed with online exams (combining system-graded multiple-choice and professor-graded short answer questions), discussion activity, group research activities, a final group project and presenta-
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Peer evaluations on the final group project ensured adequate participation and equitable point distribution. Online exams were given at the university testing center to avoid using limited meeting times, and students were allowed to take them over a four-day window to maintain scheduling flexibility. Some students initially expressed concern over use of the testing center, but after their first experience all were fine with this process.

Making Technology Choices

There are many software tools to develop course content that produce excellent results when mastered. The learning curve for each product, however, can be extensive. An interesting approach to faculty ramp-up time was used at Ohio University where some of their brightest IS majors were assigned to become subject experts on specific software packages. The students then taught the faculty how to use the tools (McGann, 2005). This method reduced the faculty learning curve while giving students an interesting challenge and a view of what teaching actually involved.

Several simulations for the security course were developed to demonstrate security tools prior to use during in-class labs. Students often hurry through detailed instructions during class labs, receiving unexpected results or bypassing software features. Cameron (2003) reported success with simulations for his hybrid networking class, showing that students who used simulations outperformed counterparts who studied static presentations. Unfortunately, there is no guarantee that students will take the time to view a simulation that required a considerable amount of production time unless a quiz or other incentive is assigned.

Simulations were developed using Captivate. While a software tool is being used on a host system, screen shots and mouse movements are automatically captured. Screen shots are arranged in a storyboard to allow the user to review the screens and add text or audio comments to explain or emphasize certain features. The default viewing times may be

<table>
<thead>
<tr>
<th>Module</th>
<th>In-Class Topics</th>
<th>Online Topics</th>
<th>Online Activities</th>
</tr>
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<tbody>
<tr>
<td>Risk, Threats &amp; Vulnerabilities</td>
<td>Network Threats Web Servers &amp; Browsers Lab 1</td>
<td>Costs of Attacks Network Integrity Secure Server Installation</td>
<td>Current incident activity Patching tips Internet use policies Lab analysis</td>
</tr>
<tr>
<td>Law, Investigation, Ethics, &amp; Privacy</td>
<td>Forensics &amp; Incident Response, Privacy &amp; Authentication Issues</td>
<td>Legal &amp; Ethical Issues HIPAA &amp; USA PATRIOT Act</td>
<td>USA PATRIOT Act debate—students assigned to pro or con position for initial posting</td>
</tr>
</tbody>
</table>
adjusted, and controls on the finished output allow a user to pause or repeat sections of interest. Editing tools allow fine tuning before the final package is compressed into Flash, QuickTime or other desired media format. The compression algorithm was highly effective at reducing a production of over 5 Mb to less than 1 Mb of output. Since media size impacts download time and user satisfaction, an ideal solution is to provide a CD of all multimedia output at the start of the semester rather than rely on varying Internet connections. An interesting comment on the 2005 class survey noted that students prefer minilectures and other audio files to be available in MP3 format so they can download and listen to them outside the Blackboard environment or in their car during commuting time.

**Challenges With Online Activities**

The most difficult aspect of design for this hybrid course was developing online activities that reinforced key concepts, engaged and interested students, and achieved the goal of higher order learning. The final set of online activities included full class and small group discussions of outside readings, exploration of technology topics and tools, team lab preparation and analyses, and discussions of legal and privacy issues. An online grading rubric with specific examples of levels of content was posted to give examples of expected contribution with differentiated levels of quality.

Students were more likely to initiate additional communication within their group space than in the full class area. The most successful online discussions were on the concept of a national identification program and a debate over the extension of the controversial USA PATRIOT Act legislation. Several activity phases were scheduled to encourage ongoing communication between face-to-face sessions. Students were assigned to research and defend a supporting or opposing position, respond to a contributor on the opposite side, then summarize what they learned and what their actual position was as a result of the exercise. Some students had not previously been aware of either initiative and had not considered that increased national security meant a personal privacy trade-off. The activity helped them relate to these topics on a personal level, while encouraging them to see how national or business needs must take precedence.

Many of the online group activities were designed to provide content for the course service learning component, a student-designed and managed Web site at [http://www.securitytips.org](http://www.securitytips.org). The purpose of the site is to enhance information security awareness and educate small business owners, local government agencies, and nonprofit organizations about security threats. It was hoped that if students knew their output would be posted to the Web for actual use they might have a higher sense of involvement and commitment to the activities. This multisemester activity was a successful, both in terms of student enthusiasm and user interest. Although the site design and implementation took more time than expected the first year, content improved significantly the second year. The latest class added automatically refreshed news feeds that continue to add new content to the site between course offerings.

Online activities in the second year included both group and individual exercises with security tools that students could perform prior to in-class labs. While the goal was to meet the constant demand for more hands-on activities, some students did not have personal systems capable of running the tools or a network connection to complete exercises. Open lab time was available for students to complete these assignments but few took advantage of this resource.

Students seemed to need more feedback for online components where they are not receiving the immediate response of a classroom environment. A clear channel of communication between the professor and students is a critical element to avoid both confusion and disengagement. While Oravec (2003) reported success with the use of blogs (Web logs) as a middle space to encourage individual expres-
sion, the author thought that private areas would be more conducive to individual reflection. Single-person “groups” were created in Blackboard to give feedback and capture student comments on the hybrid learning process and course materials. This insight proved to be useful for ongoing improvement, and as always, some contributed more than others. Whether posted in a secure viewing area, or provided in offline meetings, both supportive and corrective feedback is important to guide student participation.

**Student Reactions and Outcomes Year 1**

To monitor student expectations and reactions, the author developed a precourse survey that also doubled as an introduction to the Blackboard Assignments area, a midcourse check-up, and a postcourse evaluation. Results from the 2004 survey indicated only one student did not like the idea of a hybrid format going into the semester. He felt he would miss the in-class interaction, although in prior classroom experiences he rarely spoke in class. His actual online involvement exceeded what he normally would have contributed, illustrating a point noted by others that shy or self-conscious students often communicate better when they have time to think through their responses before sharing them (Palloff & Pratt, 2003). Expectations from the 2004 precourse survey were mostly positive, with a representative sample shown in Table 2.

By midterm we had completed several online activities as well as in-class lectures and technical labs. Students struggled a bit with online discussion in spite of a carefully developed grading rubric with samples. Online activities included a two-stage time frame in which to post initial comments and respond to others. The same people tended to post early over the course of the semester while others held back and slowly came up to speed. As several students pointed out in the mid-term comments shown in Table 3, it is difficult to gain momentum in a topic discussion with intermittent posting, and the need to check back several times became cumbersome.

The ending evaluation found the group of 15 students evenly divided between loving, hating, or being indifferent to the hybrid format. Students who felt it was a positive experience enjoyed the flexibility of managing their own time and liked the ability to think about their responses before contributing to online discussions. Students who disliked the format noted problems with finding materials, felt they received less feedback than desired, or felt the course content was too advanced for individual learning. One question of importance to the author was whether or not the students viewed the simulation and if they found it useful. Eleven of the 15 students did view it, and only one said it had not been helpful; all 11 said they would have liked to have had more. This was valuable feedback given the time required to plan and produce an effective simulation.

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**TABLE 2**

**Precourse Survey With Selected Student Comments—2004**

<table>
<thead>
<tr>
<th>2004 Precourse Survey: What is your reaction to the hybrid format discussed today?</th>
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<tr>
<td>“I think this is a very good way to express ideas, and receive feedback on those ideas. The online part of this course is really cool because it makes us practice time management.”</td>
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<tr>
<td>“Time management is sometimes missed in the educational process, and it will give us an opportunity to practically use management skills. I am looking forward to see this kind of class.”</td>
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<td>“I like the idea of the hybrid format. Being able to save a trip to campus one night each week by meeting online is a great idea. My only concern right now is how the online class activities would work in the event of a Blackboard disruption.”</td>
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<td>“I don’t think I like the new format. I’d much rather meet F2F in person with other live beings. From what I have seen, online chat group sessions have a real tendency to get off track at times.”</td>
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</table>
Additional surveys were conducted by the hybrid grant committee, along with normal course evaluations. The grant committee’s survey included a revealing question on how often students typically came to class without having read their assigned materials. The 67% response that they often came to class unprepared might explain why the hybrid format would be less desirable to some. If students use lecture and discussion time as an alternative to individual preparation, a format in which some percentage of the content has to be mastered individually may be problematic. In spite of this, or perhaps because of a forced change in learning style, exam scores were comparable to the prior traditional class offering.

**The Second Generation—Outcomes in Year 2**

Any hybrid course must allow for flexibility and will likely be an evolving product. The 2005 version of this hybrid security course included a book change, updated content to address technology changes, revised online activities, and more tightly focused outside readings. It also encompassed a greater variety of multimedia options, such as online minilectures emphasizing key points on self-study topics, and simulations of additional technical tools.

Students in the second group had more experience with both online and hybrid formats, and no one expressed any particular concerns about the format going into the semester. Flexibility in completing assignments and not having to drive to campus a second night were big selling features. This group included 19 seniors and one postgraduate who came back to take this specific class because of the topic. Overall, student interest in the security topic was high, and many felt it would help their job prospects. Midterm comments were still favorable, although complaints about online group activities began to appear.

While the overall reaction to the hybrid course experience was good, this group of students more familiar with online learning brought up several issues not revealed the first year. Table 4 reflects that some students had more motivation issues with topics they felt to be less interesting, and others felt that they lost opportunities to learn more about the subject area because of the reduced meeting time. Several perceived the online topics as less important than those covered in class, an outcome not previously reported in the literature. One student suggested that if online topics had associated quizzes, he would have spent more time on them.

With such a small sample size, it is difficult to validate any patterns between student responses and demographics such as age,

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**TABLE 3**

Midterm Survey with Selected Student Comments—2004

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<th>2004 Mid-Term Check Up Survey – How’s it going so far?</th>
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<tr>
<td>“I think the first activity went well. I like the forum of online discussion. Getting information up early seems to work better because you can get responses from more people.”</td>
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<tr>
<td>“The article was difficult to understand at times, but I think it sparked a lot of ideas looking at today, and the Coffee presentation lead to a lot of debate as to how we should proceed in the future.”</td>
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<tr>
<td>“So far I have enjoyed the format of this class. I feel this format forces me to become more involved. This is good thing because I feel as if I’m retaining more information. The only difficulty that I’m having is keeping up with the readings.”</td>
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<tr>
<td>“So far I have a mixed reaction to the online activity. It is nice to be able to post questions when you want to get quick answers however it is difficult to check the site frequently. I find it difficult to get a discussion going in a couple of days without checking blackboard multiple times a day, something that is often difficult. It is a useful learning tool but is not a replacement for face to face discussion in my opinion.”</td>
</tr>
</tbody>
</table>
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grade point average, or whether they worked full- or part-time. In general, older students seemed to see more value in the traditional class format, but also appreciated the flexibility provided with their work schedules. One or two students each semester seemed to require more coaching and monitoring to ensure they were keeping up with assignments. In the worst instance, a student missed the first three online assignments in spite of reminder e-mails; he blamed his confusion on the interface, while the majority of the class rated the interface as highly usable. Students who are self-motivated and good time managers typically perform better in the hybrid environment.

CONCLUSION

There are clearly challenges in determining what should be covered in which mode in the hybrid format. Our program emphasizes hands-on learning, so five meeting days (one-third) were dedicated to technical labs. There was only time to schedule one outside speaker, representing a significant downside to the format. Student comments about content were valid; not everything will fit in a hybrid model. Trade-offs exist as to the type of activities and topics that can be included, as well as to the complexity or challenge of online assignments. First year assessment outcomes were comparable to those of the traditional format. Changes were made for the second offering based upon student feedback, which reduced the technical nature of some assignments to accommodate the format, and thereby reduced the challenge.

The hybrid learning model is clearly not for every student, every course, or every professor. Important determinants in deciding to use the hybrid model include the appropriateness of the content, the level of course in the curriculum, and student maturity level (both social and academic). There is a large upfront commitment from the professor to redesign the

### TABLE 4

**Postsurvey Comments—2005 Class**

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<tr>
<th>2005 Postsurvey Comments: What is your final opinion of the hybrid format?</th>
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<tr>
<td>“As much as I love not coming to class one day, the hybrid format essentially made this class one where you only meet once a week and for not very long. I think we covered a great deal of material for only meeting half the time, but not as much as if we met 2 times a week. To summarize, I love not coming in for class half the time, but don’t like missing out on some of the extra information.”</td>
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<td>“I definitely felt I had a little more flexibility in getting work done. The online/@home activities were nice for me because I could get them done when I had the time, normally before the due date which then allowed me to focus on other activities or courses. This required a lot of time management, AND the more I get to use my time management skills the better they can become! I definitely struggled with some activities, but I feel confident that I succeeded, learned, and evolved from the experiences in this course.”</td>
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<tr>
<td>“It did offer flexibility as far as when and where assignments could be completed. However, it also presented difficulties where an entire week would pass between classes, making it occasionally easy to lose track of assignments, deadlines, and topics in the face of the more pending work from other courses.”</td>
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<tr>
<td>“I do not like hybrid course as much as traditional course. I find I can’t find the time outside of class to always be checking blackboard to make sure I have an assignment due, as with a traditional course the professor will have told in the previous class.”</td>
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<tr>
<td>“Personally, I think the hybrid format kind of crippled the class. In the future, the fact that a class is hybrid would definitely make me question whether or not I’d like to take the course. The main problem I had with the hybrid class is that it made it hard to take the class as seriously as the other classes that met twice a week, which was especially bad since this was the class I enjoyed the most and wanted to take the most out of this semester. Let me make it clear that you have done an excellent job instructing and went above and beyond with this class; that I’m very happy with. However, the hybrid format seemed to steal some of the momentum the class had going for itself.”</td>
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</table>
course and prepare online materials, as well as ongoing computer time to respond to questions, observe discussion activity, and provide feedback.

Figure 1 summarizes suggested building blocks for success with any distance education program. The organizational environment and the maturity of technical support should be carefully considered; faculty interest, reward structure, and support for course redesign are equally important factors in achieving program success. Student maturity and learning styles are also important, but uncontrollable, components of hybrid model outcomes.

Student communication needs must be carefully considered, as well as their interest in trading professor contact for time flexibility and online interaction with their teams. Communication clarity is critical, yet it is almost guaranteed that students will misunderstand something over the course of the semester.

Generally speaking, the hybrid model is more challenging and interesting for the professor, both in terms of upfront time and commitment to technology, but there is a sense of being more remote from students. While we have the opportunity to emphasize critical thinking assignments in online work, there is reduced contact time and therefore the student/faculty social dynamic also changes. The hybrid model is not a one-size-fits-all solution, but another valid option in the modern learning environment that must continually evolve to meet learning needs.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>• Time and place flexibility</td>
<td>• Self managed time skills required</td>
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<tr>
<td>• Strong appeal to working students</td>
<td>• Some missed excessive class meetings</td>
</tr>
<tr>
<td>• Variety of learning methods &amp; tools</td>
<td>• Less ability to observe learning success</td>
</tr>
<tr>
<td>• Reduced lecture during the term</td>
<td>• Topics not covered in class perceived to be of lesser value</td>
</tr>
<tr>
<td>• Multiple opportunities for social interaction in both formats</td>
<td>• Difficult to design challenging online activities for technical topics</td>
</tr>
</tbody>
</table>
REFERENCES


Cameron, B. (2003). Effectiveness of simulation in a hybrid and online networking course. *Quarterly Review of Distance Education, 4*(1), 51-55.


