
AC 2011-503: BRINGING A TECHNOLOGY ENTREPRENEURSHIP CURRICULUM ONLINE AT THE UNIVERSITY OF MARYLAND

James V. Green, University of Maryland, College Park

Dr. James V. Green leads the education activities of Mtech at the University of Maryland as the Director of Entrepreneurship Education with responsibilities for the Hinman CEOs Program, the Hillman Entrepreneurs Program, and the Entrepreneurship and Innovation Program. As a Senior Lecturer and Associate Director with Mtech, Dr. Green designs and teaches undergraduate and graduate courses in entrepreneurship and technology commercialization. He leads Mtech's international entrepreneurship education initiatives to include establishing and managing partnerships. Dr. Green's research interests include entrepreneurship education and the psychology of entrepreneurship. Prior to Mtech, he provided business development and product management to WaveCrest Laboratories (acquired by Magna International, NYSE: MGA), an innovative start-up in next-generation electric and hybrid-electric propulsion and drive systems. At Cyveillance (acquired by QinetiQ, LSE: QQ.L), he served in operations, client service, and product development roles for this software start-up and world leader in cyber intelligence and intelligence-led security. While at Booz Allen Hamilton, he provided technical and programmatic direction to the DARPA Special Projects Office (SPO), Army Research Lab (ARL), Defense Technical Information Center (DTIC), Information Assurance Technology Analysis Center (IATAC), and other DoD clients. Dr. Green earned a Doctor of Management and an MS in Technology Management from the University of Maryland University College, an MBA from the University of Michigan, and a BS in Industrial Engineering from the Georgia Institute of Technology.

Bringing a technology entrepreneurship curriculum online at the University of Maryland

Abstract

The demand for online teaching and learning is presenting new opportunities to bring technology entrepreneurship courses online. With one in four college students taking an online course, and an increasing number of students interested in technology entrepreneurship courses, this intersection creates an emerging demand for online technology entrepreneurship courses (Clayton, 2010).

With existing literature largely answering the question of (a) what are the benefits for the students in online technology entrepreneurship courses versus face-to-face courses and (b) what are the barriers to learning for the students in online technology entrepreneurship versus face-to-face courses, the outstanding questions of the methods that are efficient and effective to create and deliver online technology entrepreneurship courses are examined herein.

At the University of Maryland, priority for introducing online technology entrepreneurship course is placed on courses that are already created and offered regularly face-to-face on campus. Face-to-face courses are recorded on video and catalogued for later use in online sessions. This provides a tested syllabus with proven deliverables and existing pedagogy. From a technology perspective, preference is given to technologies that are already familiar to students and faculty. A dynamic offering of video-based lecture content inclusive of course slides is the basis of the online course.

Learning objectives and achievements for the online course match those of the corresponding face-to-face course. The online learning approach at University of Maryland requires active faculty monitoring and participation within the online classroom. While an added requirement beyond typical face-to-face classes, the net time savings for faculty by teaching an online course is substantial when compared to live lecture time saved.

Based on student course evaluations, the average difference on a 4.00 scale is 0.15, with face-to-face sections narrowly outscoring online sections. This difference of 3.75% is negligible; meaning the learning experiences as evaluated by students is equivalent between online and face-to-face sections when the University of Maryland's approach to bringing technology entrepreneurship courses online.

Introduction

The demand for online teaching and learning is presenting new opportunities to bring technology entrepreneurship courses online. With one in four college students taking an online course, and an increasing number of students interested in technology entrepreneurship courses, this intersection creates an emerging demand for online technology entrepreneurship courses (Clayton, 2010). With 27 percent of high school students and 21 percent of middle school students taking at least one online class in 2009, nearly doubling the 2008 numbers, the desire for online courses at the collegiate level will surely increase (Clayton, 2010).

Educators are recognizing that online courses can deliver a high quality educational experience for students and faculty (Arbaugh, Desai, Rau, & Sridhar, 2010). The next question is how best to create and deliver online courses at the collegiate level. This brings to question what courses and learning objectives are best aligned with an online delivery format; in addition to questions of technology and faculty training in online delivery.

Consequently, this study focuses on two critical questions from the student perspective, and two important issues from the faculty and administration perspective. The questions are focused on technology entrepreneurship courses as this is the interest area and expertise of the authors.

- What are the benefits for the students in online technology entrepreneurship courses versus face-to-face courses?
- What are the barriers to learning for the students in online technology entrepreneurship versus face-to-face courses?
- What methods are effective to create and deliver online technology entrepreneurship courses?
- What methods are efficient to create and deliver online technology entrepreneurship courses?

As the first two questions of the student experience are paramount to a successful online learning experience, these are antecedents to concerns of the effectiveness and efficiency of the course delivery. However, with rising pressures on technology entrepreneurship faculty time and the need to do more without more resources due to the current budget climate at many universities, cost and time efficiency plays a central role in the course design and delivery methods discussed herein.

Literature Review

The opportunities and challenges of online collegiate courses have been widely discussed in over 1,300 scholarly articles in the last decade. Studies have documented both favorable and unfavorable perceptions by students and faculty on online learning. Journals have been started to explore and examine this topics, to include *Internet and Higher Education* among others.

In the U.S. and abroad, institutes, foundations, and corporations have coalesced to develop standards and benchmarks for higher education online learning. A notable example is the “Quality on the Line” report in the U.S. by The Institute for Higher Education Policy in

collaboration with the National Education Association and Blackboard (IHEP, 2000). In the United Kingdom, the Higher Education Academy and the Joint Information Systems Committee collaborated in 2004 to lead a UK-wide higher education online learning benchmarking exercise (European Institute for E-Learning, 2004). In Australia, Jackson (2001) described an Australian longitudinal benchmarking example at the University of Technology, Sydney that involves cycles of continuous institutional improvement of online learning provision. While the processes differ to an extent across these and other studies and reports, a common set of themes emerge as significantly contributory to a beneficent students experience in online learning.

Central themes emerging from past studies that contribute to a positive student experience in online learning and a high level of course satisfaction are listed in Table 1 as summarized by Paechter, Maier, and Macher (2010). The relative priority of each category (1 being the highest) based on the Paechter, Maier, and Macher (2010) study is provided in the far right column.

Table 1. Students' expectations of online courses

| <i>Category</i> | <i>Items</i> | <i>Sources</i> | <i>Priority</i> |
|---|---|--|-----------------|
| A. Importance of variables concerning course design | 1. A clear and organized structure of the course and learning material 2. Usability of the platform 3. Favorable cost-benefit ratio of effort and learning outcomes | Brophy, 1999; Chang & Tung, 2008; Lee & Lee, 2008 | 1 |
| B. Importance of variables concerning the interaction with the instructor | 4. Fast feedback from the instructor 5. Counseling and support of learning by the instructor 6. Possibility to establish personal contact with the instructor 7. Easy and fast accessibility of the instructor 8. Expertise of the instructor in the implementation of e-learning courses | Johnson, Hornik, & Salas, 2008 | 2 |
| C. Importance of variables concerning individual learning processes | 9. Flexibility of learning with regard to time and place 10. Flexibility in choice of learning strategies and pace of learning 11. Opportunities for self-paced chapter exercises and the application of one's knowledge 12. Opportunities for controlling one's learning outcomes (e.g. by self-tests) 13. Support for maintaining learning motivation | Pintrich, 2000; Narciss, Proske, & Körndle, 2007 | 3 |
| D. Importance of variables concerning learning achievements | 14. Acquiring knowledge and skills in the subject matter 15. Acquiring skills on how to apply the knowledge 16. Acquiring skills in communication and cooperation 17. Acquiring skills in self-regulated learning 18. Acquiring skills in using the internet for scientific practice | Weinert, 2001; Chiu, Hsu, Sun, Lin, & Sun, 2005 Levy, 2007 | 4 |

| | | | |
|--|---|--|---|
| E. Importance of variables concerning the interaction with peer students | 19. Easy and fast exchange of information and knowledge with peer students 20. Variety of communication tools for exchanging information with peer students (e.g., e-mail, chat, newsgroups) 21. Support of cooperative learning and group work with other course participants 22. Personal contact with peer students | Brophy, 1999; Jucks, Paechter, & Tatar, 2003; Concannon, Flynn, & Campbell, 2005 | 5 |
|--|---|--|---|

Beyond student expectations and experiences in online learning, the design and delivery of online courses must consider the faculty expectations and experiences. When designing an online course, instructors are faced with fundamental considerations and decisions that impacts how students experience instruction, interact with the instructor and classmates, and engage in learning. (Brophy, 1999; Ehlers, 2004):

Brophy (1999) states that the structure and coherence of the curriculum and the content are major factors for learning. While a critical element for online learning, this is equally critical to face-to-face instruction. The quality of the learning environment and the ability to engage in the class topics contribute to the course satisfaction regardless of course delivery method (Chang & Tung, 2008).

Within online courses, as well as face to face courses, the student-instructor interactions support knowledge construction, increase motivation, and establish a social relationship. This exchange of information regarding both educational content and socio-emotional information is important to the learning dynamic and student experience (Johnson, Hornik, & Salas, 2008; Paechter & Schweizer, 2006; Richardson & Swan, 2003). As noted in the case of the structure and coherence of the curriculum, this element of interaction is also important to face-to-face course environments.

Paechter, Maier, and Macher (2010) found that the instructor’s support of learning most strongly contributes to learning achievements and student course satisfaction. Students attribute the instructor’s counseling and support as key contributors to their development of course knowledge, the acquisition of media competence required of online learning, and for overall course satisfaction.

Furthermore, students share that the instructor’s expertise in the creation and management of the online course is a key success factor. Beyond the normal activities and content of a face-to-face course, the online version of the course benefits the student experience by adding multimedia elements (Paechter, Maier, & Macher, 2010).

Learning management systems to include Blackboard and WebCT integrate a breadth of online instruction tools, such as discussion boards, announcements, email, online content areas, Internet links, and grade books. The opportunities presented by these online learning platforms include enhanced experiences for students in terms of improved quality of learning, greater productivity of learning, and improved student attitudes towards learning (Alexander and McKenzie, 1998; Martin & Webb, 2001). In a related study, Coates, James, and Baldwin (2005) note six drivers of the rapid adoption of learning management systems:

- a means of increasing the efficiency of teaching
- the promise of enriched student learning
- new student expectations for advanced technologies
- competitive pressures between institutions
- a key means of responding to massive and increasing demands for greater access to higher education
- part of an important culture shift taking place in teaching and learning in higher education (p. 23–5)

For the sixth driver, Coates et al. (2005) argue that, “LMS offer universities a hitherto undreamt-of capacity to control and regulate teaching. From a managerial perspective, the disorder associated with academic independence and autonomy in the teaching and learning process can appear chaotic and anarchic ... LMS may appear to offer a means of regulating and packaging pedagogical activities by offering templates that assure order and neatness, and facilitate the control of quality (p. 25).”

Methods

With existing literature as discussed here largely answering the question of (a) what are the benefits for the students in online technology entrepreneurship courses versus face-to-face courses and (b) what are the barriers to learning for the students in online technology entrepreneurship versus face-to-face courses, the outstanding questions of the methods that are efficient and effective to create and deliver online technology entrepreneurship courses are examined.

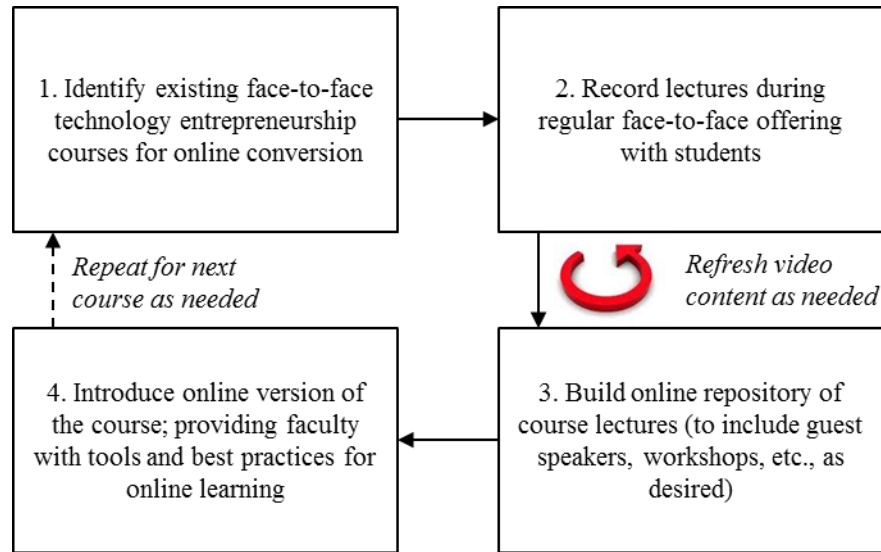
The effectiveness of the online course format presented will be measurable by course evaluations and the quality of student deliverables. The methods that are efficient to create and deliver online technology entrepreneurship courses will be examined from the faculty perspective.

To define the context of “online” courses in this paper, the term describes video-recorded face-to-face classes available for asynchronous viewing along with supplementary online resources to include discussion boards, document management tools, and online readings. Faculty are available via email, telephone, and online chat by appointment or at scheduled time; but not necessarily at the same time that students are watching the pre-recorded video.

Approach to online course design and delivery

The approach applied at the University of Maryland is based on a four-step process as illustrated in Figure 1. This approach of identify-record-catalogue-launch is simple in principle, and efficient in practice. The technologies used for course capture and management are discussed subsequently, as are the alignment with this method to the aforementioned students’ expectations of online courses introduced in Table 1.

Figure 1. Approach to online course design and delivery for Maryland



Operating from the basis that the benefits and barriers to online learning as discussed thus far are applicable to the students and context of technology entrepreneurship courses, attention can be focused on what matter most to these students' experiences online. Table 2 introduces the method used by the University of Maryland to align students' expectations as overviewed in Table 1 with solutions employed at the University of Maryland.

Selection of courses for online delivery

For the first step of determining which technology entrepreneurship courses to bring into the online environment, the University of Maryland focused on existing courses popular with students and in high demand for frequent offerings. These five courses are listed here.

- “ENES 461 Advanced Entrepreneurial Opportunity Analysis in Technology Ventures”: Using a cognitive theoretical framework, the course examines the integration of motivation, emotions and information processing modes to make complex entrepreneurial decisions in fast pace technology venture environments. The course is an informed and interesting exploration of entrepreneurial cognition with both theoretical and methodological contributions.
- “ENES 462, Marketing High-Technology Products & Innovations”: Marketing of high-technology products occurs in dynamic environments, and requires rapid decision making with incomplete information. Innovations are introduced at frequent intervals, research-and-development spending is vital, and there are high mortality rates for both products and businesses. The course will provide a balance between conceptual discussions and applied/hands-on analysis in these areas.

- “ENES 463, Strategies for Managing Innovation”: The course emphasizes how the technology entrepreneur can use strategic management of innovation and technology to enhance firm performance. It helps students to understand the process of technological change; the ways that firms come up with innovations; the strategies that firms use to benefit from innovation; and the process of formulating strategy.
- “ENES 464, International Entrepreneurship & Innovation”: The course focuses on the need for every entrepreneur and innovator to understand the global market in today’s hypercompetitive world, and to appreciate how to compete effectively in domestic markets by managing international competitors, suppliers, and influencers. Students develop skills to identify and manage opportunities on a global basis.
- “ENES 460, Fundamentals of Technology Start-Up Ventures”: With a focus on business plan development, students learn how to assess the feasibility of a startup venture, as well as how to apply best practices for planning, launching, and managing new ventures. This multidisciplinary course will draw on management, business, legal, financial, as well as technical, concepts.

Further courses at the undergraduate and graduate level are currently under evaluation for online delivery.

Alignment of the University of Maryland’s approach to student s’ expectations

For course design, priority for introducing online technology entrepreneurship course is placed on existing face-to-face on campus. This provides a tested syllabus with proven deliverables and existing pedagogy that can be modified for the online environment. Technologies used are those already familiar to students and faculty, where possible. Details of the variables concerning course design and the University of Maryland’s approach are provided in Table 2.

Table 2. Importance of variables concerning course design

| <i>Students’ expectations for course design</i> | <i>University of Maryland Approach</i> |
|---|---|
| <ul style="list-style-type: none"> • A clear and organized structure of the course and learning material | <ul style="list-style-type: none"> • Priority for introducing online technology entrepreneurship course is placed on courses that are already created and offered regularly face-to-face on campus • Face-to-face courses are recorded on video and catalogued for later use in online sessions • Provides a tested syllabus with proven deliverables and existing pedagogy • Syllabus and content may be modified for the online environment, but are not created from scratch as a new course |
| <ul style="list-style-type: none"> • Usability of the platform | <ul style="list-style-type: none"> • Preference is given to technologies that are already familiar to students and faculty |
| <ul style="list-style-type: none"> • Favorable cost-benefit ratio of effort and learning outcomes | <ul style="list-style-type: none"> • As existing courses are the basis for the online courses, the workload for students parallels that of the face-to-face courses |

For student-instructor interaction, instructors are expected to be responsive and supportive of students in the online learning environment. Turnaround times on inquiries are provided, and student course evaluations inquire as to the attentiveness and accessibility of the instructor. Details of the student expectations and the University of Maryland’s approach are provided in Table 3.

Table 3. Importance of variables concerning the interaction with the instructor

| <i>Students’ expectations for instructor interaction</i> | <i>University of Maryland Approach</i> |
|---|--|
| <ul style="list-style-type: none"> • Fast feedback from the instructor | <ul style="list-style-type: none"> • Instructors are expected to respond to postings/emails as soon as possible, preferably within a 12 hour timeframe |
| <ul style="list-style-type: none"> • Counseling and support of learning by the instructor | <ul style="list-style-type: none"> • Instructors are expected to demonstrate the same level of attention and commitment as in face-to-face courses |
| <ul style="list-style-type: none"> • Possibility to establish personal contact with the instructor | <ul style="list-style-type: none"> • Instructors are expected to hold office hours via conference call, video conference, or face-to-face on a regular basis as is the case for face-to-face courses |
| <ul style="list-style-type: none"> • Easy and fast accessibility of the instructor | <ul style="list-style-type: none"> • Instructors are expected to respond to postings/emails as soon as possible, preferably within a 12 hour timeframe |
| <ul style="list-style-type: none"> • Expertise of the instructor in the implementation of e-learning courses | <ul style="list-style-type: none"> • Technical support is available to the instructors to facilitate the creation and delivery of online courses • Faculty support is available to assist in instructional and pedagogical matters |

For individual learning processes, flexibility of learning with regard to time and place are maximized through asynchronously delivery of all content; with no requirements of participating in a real-time interaction. While students are required to submit deliverables as defined on the assigned timeline per the syllabus, they are able to watch the online videos and participate in online discussions at times that are convenient to them. Instructors are expected to monitor students that do not login to view and participate in the online course (as is the case with students who are absent from face-to-face courses).

Also of note in the approach is that students have the option of working with a team or individually. While this is counter to the opinion that all courses should include a team element, the experience at the University of Maryland is that teaming does not always have to happen among classmates for entrepreneurial success. Teaming can occur with friends, family, faculty, mentors, and others outside of the classroom. While students are encouraged to team to develop their entrepreneurial ideas and plans, they are not required to select students from within their specific course during that specific term to be on their team.

Details of the variables concerning individual learning processes and the University of Maryland’s approach are provided in Table 4.

Table 4. Importance of variables concerning individual learning processes

| <i>Students' expectations for learning processes</i> | <i>University of Maryland Approach</i> |
|---|--|
| <ul style="list-style-type: none"> • Flexibility of learning with regard to time and place | <ul style="list-style-type: none"> • All courses are taught asynchronously, freeing students from the need to login at a fixed time • Face-to-face courses are recorded on video and catalogued for later use in online sessions |
| <ul style="list-style-type: none"> • Flexibility in choice of learning strategies and pace of learning | <ul style="list-style-type: none"> • Asynchronous learning allows flexibility in learning style, timing, and preferences • Students are required to submit deliverables as assigned |
| <ul style="list-style-type: none"> • Opportunities for self-paced chapter exercises and the application of one's knowledge | <ul style="list-style-type: none"> • Deliverables for the online section of the course align directly with deliverables for the face-to-face section • Unlike face-to-face sections that may require team work, online courses provide students with the option of working individually or with a student-selected team of up to 3 students • Students are required to submit deliverables as defined on the assigned timeline per the syllabus |
| <ul style="list-style-type: none"> • Opportunities for controlling one's learning outcomes (e.g. by self-tests) | <ul style="list-style-type: none"> • Unlike face-to-face sections that may require team work, online courses provide students with the option of working individually or with a student-selected team of up to 3 students |
| <ul style="list-style-type: none"> • Support for maintaining learning motivation | <ul style="list-style-type: none"> • Instructors are expected to provide detailed feedback and grading on submissions as soon as possible, as is the case with face-to-face courses • Instructors are expected to demonstrate the same level of attention and commitment as in face-to-face courses • Instructors are expected to monitor students that do not login to view and participate in the online course (as is the case with students who are absent from face-to-face courses) |

Learning objectives and achievements for the online course match those of the corresponding face-to-face course. By using proven deliverables and existing pedagogy from the face-to-face version of the course, instructors are not required to create a new online course from a blank page. Instead, existing syllabuses and content may be modified for the online environment as needed. Details of the learning achievements and the University of Maryland's approach are provided in Table 5.

Table 5. Importance of variables concerning learning achievements

| <i>Students' expectations for learning achievements</i> | <i>University of Maryland Approach</i> |
|--|---|
| <ul style="list-style-type: none"> • Acquiring knowledge and skills in the subject matter | <ul style="list-style-type: none"> • Learning objectives and achievements for the online course match those of the corresponding face-to-face course • Use of the tested syllabus with proven deliverables and existing pedagogy from the face-to-face course occurs with each online course • Syllabus and content may be modified for the online environment, but are not created from scratch as a new course |
| <ul style="list-style-type: none"> • Acquiring skills on how to apply the knowledge | |
| <ul style="list-style-type: none"> • Acquiring skills in communication and cooperation | |
| <ul style="list-style-type: none"> • Acquiring skills in self-regulated learning | |
| <ul style="list-style-type: none"> • Acquiring skills in using the internet for scientific practice | |

With the final category of students expectations related to the importance of variables concerning the interaction with peer students, the University of Maryland's approach to online technology entrepreneurship courses does not require peer interactions.

The experiential nature of these courses commonly requires deliverables related to an original concept, as opposed to case studies or related objective deliverables. These requirements may include a business plan, financial plan, marketing plan, competitive analysis, or other purpose-driven deliverables.

Particularly with the high percentage of students that desire to work on their own new venture concepts within the technology entrepreneurship courses, the majority of students preference the added workload of working alone on their own concepts versus sharing a workload with peers. With this shared workload comes the prospect of sharing ideas remotely with an unfamiliar and unknown person, in most cases. Another consequence of forcing teams is that students may not be able to work on their own ideas if it is not popular enough for classmates to forego their own ideas in order to work on a classmate's idea.

While select courses may have discussion board interactions among students at a cursory level, there are no significant, required peer interactions in the University of Maryland's online technology entrepreneurship courses. The exceptions are those students desiring and willing to work on teams; joining another student's concept or recruiting students to join their own concepts.

Product analysis of the lecture capture solutions

Each of these products automates the capture, encoding, editing and publication of rich media presentations in an online environment. Differences lie in the types of inputs supported, level of hosting and support services provided, viewing platforms supports, integration with classroom hardware and software, user interfaces, and pricing. A brief summary of leading lecture capture solutions is provided here. This is not an exhaustive list, and does not include pricing as this was not collected for each company and is variable pending institution, application, and negotiation.

Accordent Technologies' Capture Station can leverage room-based and mobile hardware, to include laptops, and software to create and deliver synchronized content. Capture Station presentations can be published to an institution content management system, a web/streaming server, or be housed in the Accordent Media Management System. Presentations can be viewed via Internet browsers or as podcasts.

The EchoSystem by Echo360 provides similar array alternatives as Accordent for lecture capture and management. The company offers three different solutions as of the time of this analysis: EchoSystem Capture Appliance, Podium software-based solutions, and desktop-based tools. Each option differs in user engagement, capture input capabilities, editing functionality, content publication, and pricing.

Panopto's CourseCast supports inputs including VGA devices such as electronic whiteboards, document cameras, and PCs, or any combination thereof. The product provides automatic recoding functionality. Presentations are editable via Panopto's web-based editors. Higher educational clients have the option of a hosted solution to outsource the content management process and operate lecture capture directly from their desktop.

Qumu provides a desktop-based capture solution that provides users the ability to capture screens and pair content with their personal webcams. Qumu also offers an appliance-based solution that provides full VGA compatibility and control of up to three simultaneous camera streams.

Sonic Foundry's Mediasite is offered as a classroom-based appliance (Mediasite RL Recorder), as well as a portable appliance (Mediasite ML Recorder) for mobile recording. Fully VGA or VGI compatible, inputs including document cameras, PCs, whiteboards, and any related item can be recorded and combined with audio, video, and PowerPoint presentations. The product can be integrated with room control systems including Creston and AMX.

Tegrity Campus 2.0 enables desktop or web-based capture of content and audio or webcam capture. Both students and faculty can record content anytime and anywhere on a Mac or a PC. Content can be viewed via an Internet browser, Facebook, or streamed to most mobile devices.

Technology for course capture and management

As the products selected by the University of Maryland are not a recommendation or endorsement, the rationale for their selection and means of use are the focuses of this paper.

Based on the existing purchase of Blackboard by the University of Maryland, and the resulting familiarity with the platform and interface by students and faculty, this serves as the online home for the online courses. Blackboard is cost effective for the department, in that no direct fees are assessed, and already widely used for face-to-face courses. Commonly used features for all courses include postings of the syllabus and readings, online grade book, and assignment submissions.

Adapting the Blackboard features to accommodate online courses University of Maryland involved simple features and processes to include regular use of the announcements feature,

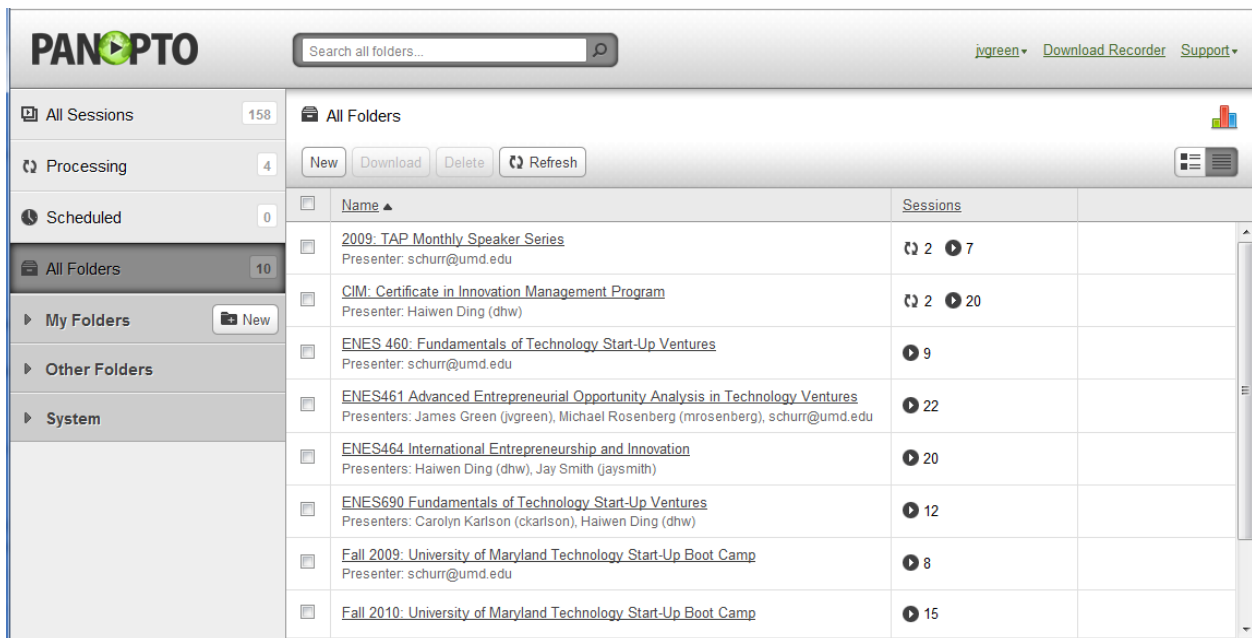
creation of discussion boards for general Q&A and topic-based dialogue, and posting of the instructor biography. The feature that was not initially available in Blackboard, and coincidentally was the most important feature needed to deliver the courses as envisioned, was a video lecture capability.

While video lectures are not synonymous with online learning, the University of Maryland believed that to provide a comparable experience for online students versus face-to-face students that full video and audio capture of an actual face-to-face course was necessary.

Panopto was selected as the provider for Mtech at the University of Maryland based on a number of factors, including its supports many different inputs devices, to include the video camera and laptop pairing that provides the mobility needed for classrooms without existing hardware. The user interfaces for capture and editing, along with the hosted solutions options, aligned with the University’s needs. Pricing was competitive versus other alternatives.

To record a lecture, a computer with the Panopto software is necessary. If a slideshow is used in the class, this is installed on the computer as well. A recently published price is \$10,500 for prepaid premium support plan including on-site support and training, installation and backup, and other services (University Business, 2009). A lapel microphone to capture the instructor’s dialogue and a video camera and tripod to capture the instructor and students are required; at a total estimated cost of \$500. Lectures are stored on the Panopto system and are viewable via the interface illustrated in Figure 2.

Figure 2. Catalogue of recorded course videos on Panopto (instructor view)



Once recorded and catalogued, instructor can select which lectures and in what order to deliver the content to students within the Blackboard environment. Links to the videos can be imbedded in Blackboard and time released to align with the course schedule. See Figure 3.

Figure 3. Blackboard – Panopto integration for online course delivery (student view)

The screenshot shows a Blackboard course page for 'ENES 460: Fundamentals of Tex: Lecture 2: Business Models & Idea Generation'. The interface includes a navigation menu on the left with options like 'Announcements', 'Syllabus', and 'Tools'. The main content area features a video player and a slide titled 'Choosing a Business Model'. The slide contains a table comparing various business models across several criteria.

| | Product | Service | Subscription | License | Advertising | Hybrid |
|--------------------------|--------------------------------------|----------------------------|--|---------------------------|---|-----------------------------|
| Scalability | Medium | Low | High | High | High | Depends |
| Profitability | Declines overtime | Medium | High | High | Very small / person, need big audience | Superior to product |
| Risks | Inventory & price comptn. | Customer develops in-house | High fixed cost | License e does not pursue | Often low | Hedged |
| Costs and funding | Need money to develop & test product | Generate revenues sooner | Expensive to build volume to cover costs | Often lowest cost | Cheap to start, Expensive to market in volume | Same as product and service |
| Reward | Can be huge company | Very profitable company | Similar payoff to products | May be small | Depends on marketing success | Best of both worlds |

Results & Discussion

Student evaluations from the University of Maryland’s standard course evaluation process are provided in Table 6. To focus on the differences attributable to online versus face-to-face learning, this data is limited to four courses taught by the same professor on the same topic. The same syllabus, aside from deliverable dates, was used for all sections.

Table 6. Course evaluation reports for online versus face-to-face sections

| <i>Items</i> | <i>Online Sections of XX (Dr. XX)</i> | <i>Face-to-Face Sections of XX (Dr. XX)</i> | <i>Difference (Online vs. Face-to-Face Sections)</i> |
|--|---------------------------------------|---|--|
| The course was intellectually challenging. | 3.32 | 3.22 | +0.10 |
| I learned a lot from this course. | 3.41 | 3.52 | -0.11 |
| The instructor treated students with respect. | 3.43 | 3.35 | +0.08 |
| The instructor was well-prepared for class. | 3.38 | 3.73 | -0.35 |
| The instructor helped create an atmosphere that kept me engaged in course content. | 3.35 | 3.52 | -0.17 |
| The instructor was effective in communicating the content of the course. | 3.16 | 3.6 | -0.44 |
| The instructor was responsive to student concerns. | 3.36 | 3.43 | -0.07 |
| Overall, this instructor was an effective teacher. | 3.28 | 3.54 | -0.26 |
| Average | 3.33/4.00 | 3.49/4.00 | -0.15/4.00 |

Based on student course evaluations detailed in Table 6, the average difference on a 4.00 scale is 0.15, with face-to-face sections narrowly outscoring online sections. While the face-to-face sections score higher on more items, this difference of 3.75% is negligible. The learning experiences as evaluated by students are therefore equivalent between online and face-to-face sections when the University of Maryland’s approach as detailed in the Methods section is applied.

Individual comments provided anonymously by students of the online courses exhibit an overall positive experience. All comments from a recent course are included here in the unedited, original form.

- “The material was very interesting and useful, but it was a lot to cover in 6 weeks. I wish that the length of the course could have been more than 6 weeks, allowing for more time between assignments.”
- “Course content is upto the mark and i think the length of this course would extend for 1 more week to fully and effectively cover the syllabus.”
- “As for the work load, I think the work load would have been fine for a regular semester. For a summer session I think there was too much reading that the assignments relied on and not enough time. It might be wise to release all the lectures ahead of time so that

students can go at their own pace while having deadlines for assignments and only after the deadline ALL assignments would be graded.”

- “Professor presented material very nicely. The power point presentations with audio really added to the feel of the class. One suggestion would be to, if possible, provide a rubric or more specific guidelines for assignment expectations. Understandably this is difficult given the nature of the content.”
- “I though the online format was great, however it was hard to create some of the items of our own, especially the financial statements.”
- “all courses should be available online.”

While the deliverables and pace of the course on a short timeline (in this case, a six-week summer session) are consistent themes for student feedback, the comments of the online format are positive.

The quality of student deliverables in the online and face-to-face courses, and the distribution of grades in the courses, was also consistent. The students’ ability to demonstrate their understanding of the course content through the creation of entrepreneurship-based plans, analyses, and proposals was consistent across the online and face-to-face formats.

With the effectiveness of the course measurable by course evaluations and the quality of student deliverables, the faculty perspective on the methods that are efficient to create and deliver online technology entrepreneurship courses deserves attention.

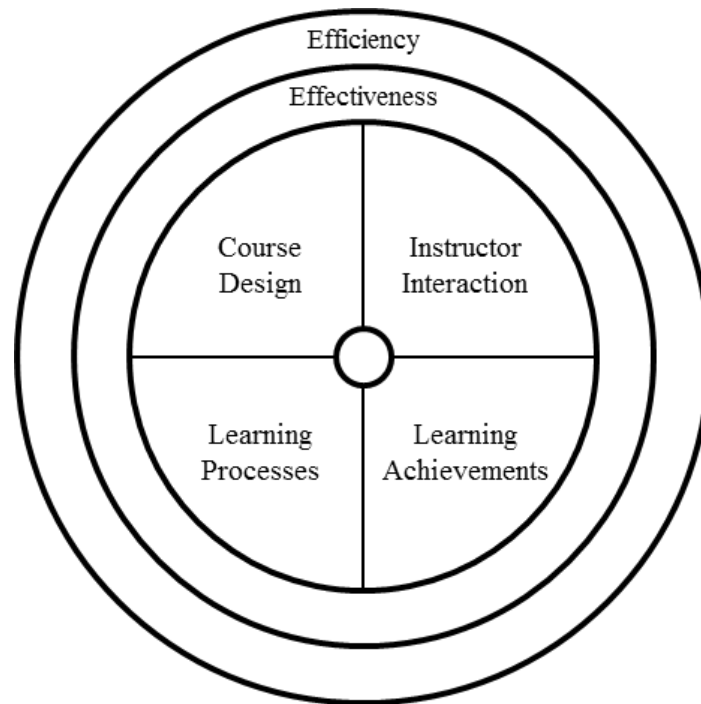
Based on this case study at the University of Maryland, the role of the faculty beings with the video capture and cataloguing within Panopto. Once the video lectures are catalogued, it is necessary to post the links in Blackboard and set the schedule for viewing access by students. These steps essentially create the lecture component of the course for the semester of interest, saving approximately 40 hours of live lecture required of a 3-credit face-to-face class.

The online learning approach at University of Maryland requires active faculty monitoring and participation within the online classroom. This includes frequent announcements, discussion board management, and related items. While an added requirement beyond typical face-to-face classes, the net time savings for faculty by teaching an online course is substantial when compared to live lecture time saved.

Conclusions

The University of Maryland__ approach to online learning provides unique insights into a model that delivers on the student expectations as defined by Paechter, Maier, and Macher (2010). Per Figure 4, the four interior elements of the model represent the four student expectations areas. With attention to effectiveness and efficiency as the bounding parameters of the model, a technology entrepreneurship curriculum can be brought online successfully as demonstrated by Mtech.

Figure 4. Model for online course design and delivery at Mtech



While subsequent research to further test this model and approach are underway at Mtech to include inclusion of further courses, these initial results provide a high level of confidence in the approaches and methods prescribed herein.

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