

2006-961: A SCALABLE PROBLEM-BASED LEARNING SYSTEM FOR ENTREPRENEURSHIP EDUCATION

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A Scalable Problem-Based Learning (PBL) System for Entrepreneurship Education

EXECUTIVE SUMMARY

Entrepreneurship skills are vital to the future of the US economy and its ability to support continual wealth creation. Traditional educational methods do not teach such skills; indeed they may hinder them. The initiative described creates a new way to provide a valuable entrepreneurial learning experience to a large number of students at all levels. This can only be achieved by developing a “scalable” model to reduce teacher load in course creation and management, and student interaction. This paper describes a pilot experiment at State University, the first of a four stage plan to make entrepreneurship education available to the majority of students in the US.

To date 135 students developed entrepreneurial skills at State University using a unique problem based learning (PBL) approach with all course materials and grading managed on-line. The results of the pilot indicate that a problem based, on-line approach to learn entrepreneurship is viable with significant upside potential. Surprisingly, it was just as difficult for the faculty to get out of the traditional “teaching mode” as it was for the students to get out of the “passive learning” mode. Nevertheless, the students’ final projects and presentations suggest that the learning experience succeeded and students developed a realistic understanding of what it takes to be an entrepreneur. Further, the experience resulted in a plan of improvements to the method, three of them key. First, given the natural ambiguity of PBL to develop entrepreneurial skills, it is imperative that structural aspects of the course are as unambiguous as possible. Second, the grading and support structure of the course need to reward student self-sufficiency. Third, in-class activities must be structured so that teams are forced to be fully prepared for each session so that facilitators are not tempted to regress to “chalk and talk” style.

1: INTRODUCTION

This paper reports on a pilot, cross-college course that is the first step in a multi-year program designed to expand entrepreneurship learning for all interested students in the State University

system and then to educational units throughout the USA. The acquisition of entrepreneurial skills is vital for assuring the future of the US economy in a changing global knowledge based environment. However, there is to date no system of course materials that can adequately support a broadly available entrepreneurship educational initiative at the K-12 and College levels. In response to this important national need, this course was conceived within the Center for Corporate Innovation and Entrepreneurship at State University with financial support from the Ewing and Marion Kaufmann Foundation as well as State University Colleges of Engineering and Business as a first step in a multi-year program designed to develop entrepreneurial skills throughout the USA.

Phase I (2003-2004) in the program is to establish a strong entrepreneurship undergraduate problem-based learning (PBL) course using the latest on-line course management system. The course, entitled “Introduction to Entrepreneurship”, is cross-listed as a business and engineering class (BA/ENGR497G) to attract students from across the university from all majors. Phase II (2004-2005) in the program, now in progress, is to encourage faculty at other Colleges and Campuses within the State University system as well K-12 teachers throughout the state of “blank” to use the “generic case-based” course platform developed in Phase I to create new entrepreneurship courses targeted at specific student levels and focus areas. The idea is to design cases specific to core subjects such as agri-science, biotech, liberal arts, science, and information technology to target the course as needed. This Phase II effort is also financially supported by the Ewing and Marion Kaufman foundation, the College of Business and the College of Engineering at State University. Phase III (2005 start) in the program is to create enhanced graduate courses in entrepreneurship using the new platform in the Colleges of Engineering, Science and Business. The final step, Phase IV (2006 start), is to offer the new, tested course materials to other Universities and secondary education institutes throughout the US. The dissemination of the courses and pedagogic methodology will be accomplished through a “Center of Entrepreneurship Learning” at State University, which will provide teachers unaccustomed to these methods and materials with training and course customization resources. The planning phase of this center is funded by the Ewing and Marion Kaufman foundation as well as the Business College at State University.

In Phase I (2003-2004), the pilot BA/ENGR497G course was developed and delivered. The key learning objective of this course was to have students acquire entrepreneurial knowledge and skills. The learning process focused around problems that introduced key concepts of entrepreneurship using custom material with web-accessible and other rich media content. The students worked in diverse teams (no more than two members from one major) of three to six students using on-line course management software (ANGEL). The challenge to each team: develop a new venture concept that could grow to \$50M in annual revenue by year 5. The course deliverables were an executable plan, an elevator pitch, and a formal investor presentation. The students learned about and then implemented solutions to entrepreneurial issues including bootstrapping, opportunity identification, intellectual property and financial management including fund-raising. Thus they experienced an integrated learning experience around a real-world entrepreneurship activity. In addition, the students were required to undertake on-line and library research as they sought answers to the challenges they uncovered.

The PBL approach of this course was aimed at approximately one half of the traditional face-to-face session time for a university course. The expectation was that students would cover the on-line materials before class, with class time focusing on applying the reading material's concepts, with faculty mentoring, to the team's product/venture concept. Thus faculty time could be leveraged and basic learning responsibility placed more on the students. The approach creates a heavy classroom load at the start of the course for the faculty to ensure the PBL approach is understood by the students, but the faculty members can then move towards a mentoring and guidance role as the course progress. When appropriate, teaching assistants were used to monitor team meetings. Some mentoring is also provided by e-mail messaging.

In addition, by using an advanced course management infrastructure two other major barriers to scaling PBL learning, namely investment in course development and managing the more complex logistics associated with PBL are largely overcome.

2. AN INTRODUCTION TO PROBLEM BASED LEARNING

First implemented in the 1950's by Case Western Reserve University and in medical schools in the 1970's, problem-based learning (PBL) has now permeated throughout all levels of the education

system, including K-12 (San Diego State University 2004). Additionally, PBL is viewed as an effective approach to developing scientific, mathematical, and technological talent and creativity (Nowak and Plucker, 1999). PBL means learning is student-centered with teachers acting primarily in the role of facilitators (COSI, 2004; Samford University, 2004; San Diego State University, 2004). Students are encouraged to actively work with material and turn to the teacher for advice, mentorship, and answers to specific problems instead of being a passive recipient of lectures. As a result, students assume greater responsibility for their own learning and are free to engage problems as deeply as they like. Further, students work in small groups to develop multiple solutions to problems. In this fashion the students are able to learn from each other's experiences and perspectives instead of just reciting material from textbooks. Finally, learner assessments include faculty grading of deliverables as well as self and peer evaluations.

Most importantly, PBL challenges the learner with loosely-structured, complex problems that act as the focal points and stimuli for the course. By focusing on such problem solving, PBL encourages the learner to originate and develop ideas as part of the learning process. PBL provides more meaning, applicability, and relevancy to classroom materials while also facilitating the development of the critical analysis skills that are needed for entrepreneurship (Michaelsen, 2001; Spence, 2001). Furthermore, PBL helps foster an entrepreneurial environment by encouraging students to extrapolate learning from other experiences and apply them to solving a problem at hand, much as entrepreneurs do as they develop new business opportunities.

There are, however, barriers to wide adoption of PBL for entrepreneurship. First, students are accustomed to highly structured textbook teaching and often feel lost or unguided within a PBL environment. A key part of the learning experience, however, is to have students cope with ambiguities and uncertainties. Second, more preparation time is needed with PBL especially with the problem formulation and the initial development and use of on-line course management technology. Once the course materials are gathered and posted and learning objectives are clearly understood for each module, however, the use of the course modules and an integrated computer support platform reduces the per-session preparation time considerably. Third, many faculty lack the incentives to engage in PBL as well as the facilitation skills required to make the format work well. Faculty that are used to predictable outcomes, usual in a textbook based linear pedagogy, find

the uncertainty inherent in PBL somewhat daunting initially. Therefore, it is important that faculty be provided the training in the skills necessary for effective PBL. Such effectiveness can be raised through “teach-the-teacher” methods, which can also be enhanced using computer-supported learning modules.

In spite of these challenges, on-line problem-based learning presents the learner an exciting opportunity for real world learning, within a flexible, “always on” 24-7 environment. Once the ambiguous nature of PBL is understood, students interact with peers and instructors according to their schedules and communicate in a way that is surprisingly natural to them. From the faculty perspective, the mentor intensity required for classroom based PBL learning has restricted the application to small student populations. Nevertheless, the approach used in BA/ENGR497G – *Introduction to Entrepreneurship* solved these logistic and resource limitations by applying computer enhanced PBL methods to entrepreneurship education. This on-line approach means many new developments and many more students will be prepared to be more effective entrepreneurs when they enter the workforce or start their own company.

3: PHILOSOPHY OF DEVELOPING ENTREPRENEURIAL SKILLS

3.1. Theoretical Frameworks

Despite common misconceptions of entrepreneurship, it is a rigorous and highly valued management discipline that is inherently opportunity driven. There are many definitions and approaches to conceptualizing entrepreneurship. For instance, Schumpeter argued that entrepreneurs were daring spirits who “created technical and financial innovations in the face of competition and falling profits - and that it was these spurts of activity which generated (irregular) economic growth (New School, 2004: <http://cepa.newschool.edu/het/profiles/schump.htm>)” Shane holds that “entrepreneurship is about perceiving an opportunity or a gap to create value that involves assembling resources under uncertainty and then recombining those resources so that new goods or service enter into a marketplace .”¹ Kirzner argues that the economy is in a state of disequilibrium and there are opportunities that are discovered by surprise and people who discover them (entrepreneurs) bring the economy back into equilibrium (Kirzner, 1997). Knight contends there is uncertainty in the marketplace and that some people will bear this uncertainty because they

¹ Scott Shane in conversation August, 2003

are more risk taking than others. From Knight's perspective, some choose to be laborers and some are more willing to be entrepreneurs (Knight, 1964). Casson views the entrepreneur as a decision making specialist (Casson, 1982) while Venkataraman argues there are people that are enterprising and there are opportunities that are valuable and when the two come together you have entrepreneurship (Venkataraman, 1997). Whatever conceptual framework is supported, it is generally recognized that entrepreneurs require specific skills, and these, by and large, can be exposed and enhanced by experience. The PBL method followed here, is designed to provide students with an intense learning experience to stimulate the entrepreneurial spirit and to provide the tools so that execution of the opportunity is more likely to be successful.

3.2. Applying PBL to Entrepreneurship Experiential Learning:

By challenging students with new product/venture opportunities and having them research and understand the requisite realities around these opportunities, students are provided with the best way to learn entrepreneurial skills. In this way, students can taste the passion of entrepreneurship within a balance of constraints and a safe learning environment where errors do not cost them a lifetime of savings. Research shows that entrepreneurial skills can be taught to a broad range of students and are applicable in many business and life situations that need not entirely be confined to start-ups. For example, The Brandeis University/National Foundation for Teaching Entrepreneurship (NFTE) impact study administered an "entrepreneurship knowledge" pre/post test at 60 program sites in which 59 increased in average scores, 3 sites more than doubled their average scores, and another 10 sites increased their average scores by 60%. Further, 97% of the program alumni surveyed by Koch Foundation researchers reported that the program improved their business skills and knowledge (Koch Foundation, 2004).

BA/ENGR497G covers the broad management skills required by entrepreneurs such as opportunity identification, business planning, marketing, competitive analysis, cash management, financing, personal, and team skills. Importantly, entrepreneurship skills are value for students in a wide range of disciplines. Therefore the format of BA/ENGR497G is flexible enough to reach beyond business, science, and engineering and can readily be extended to other disciplines such as philosophy, communication, art and education. Thus students in liberal arts may consider how to

start a theater company, students in agriculture may learn how to become a supplier of genetically engineered turf-grass, and students in communications may launch a new on-line PR company.

The *Introduction to Entrepreneurship* course materials were built from basic modules covering the skill sets required by entrepreneurs. These modules are flexible enough that they can be updated and, most importantly, be (re)created by groups of experts and faculty members interested in transferring the course to other disciplines. The course development team at the Entrepreneurship Center initially created the modules for Corporate Innovation and Entrepreneurship, making extensive use of public and State University-owned materials that the students accessed from an on-line management system (ANGEL). ANGEL allowed the faculty to keep the entire course in an electronic format. ANGEL helps manage lessons and course content, communication between students and faculty, communication among team members, homework assignments, and grading protocols. Further, the architecture of the course was left flexible enough so that future individual course designers can create the problem/opportunity area on which the students will focus. These can be in several categories depending on the course manager's intent.

- Students select their own product/venture concept and throughout the course gradually build it into an executable plan, including funding options.
- The course manager may set up a “confined” problem to which the students can relate. Confined problems look at specific aspects of the entrepreneurial function and allow students to dig deeper in key aspects of entrepreneurship.
- The course manager may provide a specific problem having the potential of creating an entrepreneurial venture. The students research a range of solutions and define the business model with plans to build value around the opportunity.
- Students may be presented with an existing business plan for analysis and play the role of an investor. They identify the risks and how the business could be improved.

By allowing the underlying course construct to be “problem/opportunity agnostic,” the course materials can be used by course managers in many disciplines and fields without demanding major course development investment. Further, potential facilitators do not need to have detailed knowledge of all aspects of entrepreneurship since the basis of learning entrepreneurial skills are provided via the modules that are already in place. The facilitator can focus, instead, on how the student's ideas would play out in the specified field. In addition, ANGEL has many embedded

tools for course design/upgrading and administration including self-testing modules, grading facilities, help guides, team management components, and scheduling capacity. Thus, faculty time is spent on direct student interaction and mentoring rather than on rote “chalk and talk” delivery and administration. The modules also require students to undertake focused web-based, and electronic library searches—important skills for entrepreneurs who are often integrators, modifiers, and synthesizers of others’ disparate information.

A more detailed outline of the course modules is provided in the separate document, “A guided tour of the pedagogy.”

4. COURSE MANAGEMENT SOFTWARE - THE STATE UNIVERSITY “ANGEL” SYSTEM

State University provides the ANGEL on-line course management system to facilitate on-line learning. The ANGEL system is accessible by all students from any computer that is linked on line and has a web browser installed. The ANGEL system allows all materials to be stored on-line and facilitates the student’s ability to work with the material on their own schedule. In addition the system provides conduits for communication among students in the form of specialized chat rooms as well as facilities for posting materials and other information as it is found. Finally, the system provides a fully computerized course management system so that all assignments can be submitted on-line as well as graded and managed on-line by the course facilitators.

Figure 1 (see Appendix A) provides an overview of the course home page. There are facilities for keeping in touch, setting appointments on the calendar, maintaining course enrollment and other tools. Files available at this level include the overall introduction to the course, short biographies of the entrepreneurs who have contributed to the course, and directories for each week’s materials and activities.

Figure 2 (see Appendix A) provides a view of the contents of one of the week's directories. The contents include files in a variety of formats including PDF, MS Office or WAV formats. At the bottom of the figure are two "drop boxes." These boxes are used for submitting graded assignments and progress reports. These boxes can be date managed so that they open at a predetermined time and then close once the deadline for assignment submission has passed. Facilitators can access these boxes to examine submissions, provide feedback, and grade the students.

Figures 3 and 4 (see Appendix A) provide examples of some of the course management tools. In figure three there is a record of the amount of email exchanged and online activity engaged in by students over a specified period of time. Figure four provides a list of students who have accessed a particular reading. Figure 5 (see Appendix A) shows the Tools page where both faculty and students can control their ANGEL system and get additional information. Clearly some tools are restricted for faculty use while others, such as "my grade book," are of interest only to the student.

5: THE COURSE EXPERIENCE

5.1 Overview

The pilot *Introduction to Entrepreneurship* course ran in two sections in Spring Semester 2004, with each section meeting once a week for two hours. Two instructors and two graduate students managed the course. Students worked on teams formed around a new venture concept that was presented by a class member who recruited people onto the venture team or around a lead-in problem or "confined" problem presented by the instructors. For the two sections, eleven students presented new venture ideas and six teams eventually emerged to develop these ideas. Those opportunities included the development of a home bulk delivery system, high-end gaming computers, the development of unique music download services (two teams on this concept), a multi-functional entertainment complex, and a music production company for emerging artists. The four other teams worked within "confined problems" and worked on new ventures for capital equipment leasing, stem cell storage, a student-art distribution service, and an automobile-based information service.

During the fall 2004 semester an additional fifteen teams were engaged in the method. The projects included web-sites for students text book exchanges, a topical pain relief cream, a line of men's self-care products, learning packages for scientific education, a new clothing design and sales system, and an on-line destination guide book. A more detailed report of the team's activities will be provided during the Academy of Management meetings in the summer of 2005.

5.2 Course environment

Class was typically held in "non-technology" rooms, which meant no direct access to ANGEL, the computer based course content, or the Internet during class time. In addition, students purchased a \$25.00 DVD that contained a number of videos that related to each of the weeks on-line modules, which were to be viewed each week before class. Finally, attendance for the course was not taken: the course was structured to be for students who wanted to be entrepreneurs. Attendance was, however, the strongly suggested alternative.

The first section, which met on Monday, experienced the most turnover and the class size ranged from fifty to a final count of thirty-nine students. Because the course was an elective course, people continued to sign up and drop out of the course three weeks into the term. This lack of stability made it difficult to communicate what was expected of the students and how the learning activities were structured. This was in stark contrast to the one in the second section, which met Thursday afternoons. This second section had very little turnover and stabilized at 16 students by the second week with only one late addition. Although this class was also conducted in a non-technology room, the students expressed less confusion or trouble with the on-line ANGEL-based course, regularly submitted their assignments on time, and used the system to full advantage.

5.3 Stages in the course

The course began with standardized lectures for three weeks. By the beginning of the fourth week students formed teams, and class time began to shift to a mix of on-line material discussion and team meeting time with the teachers and TAs acting as mentors. Approximately half of the total of 11 teams were able to easily understand how to apply the week's on-line reading to analyzing their new venture. However, some of the teams did not meet outside of class and only worked on the project during the class time. These teams struggled more than the others when it

came to engaging the on-line material and seemed more confused about what the overall expectations of the course were, when assignments were due or what work was expected of the teams and individuals in the class. The situation became problematic enough that the first section of students was directly confronted and pointedly told that the expectation was that they would keep abreast of the class assignments by following the index on the web and that work that was late or off topic would not be tolerated.

Although a straightforward lecture approach was never adopted, it proved difficult for the faculty to move away from the lecture/material review approach to leading the classes. For example, given that he had substantial experience working with start-ups and entrepreneurs, it was easy to let the lead instructor engage in telling stories about his own experiences on the week's topic. These "been there / done that / learned this" reviews were very well received: the students enjoyed the stories a great deal and helped them see how a topic such as competitive analysis applied to their team's venture and many students commented in course evaluations that these stories were a highlight of the course. Nevertheless, the teaching team sometimes ended up explaining concepts in great detail instead of listening to the teams' struggles with the topic of the week.

By the eighth week (of the 14-week semester), it became very clear that some students were struggling with the ambiguity inherent in the course. Nevertheless, it was decided to stay the course in the hope that the students would eventually come to grips with the ambiguity and work their way through it. It was also emphasized to the class that in spite of their discomfort it was important to develop a facility with ambiguity, as the entrepreneurial world is nothing if not ambiguous. To help focus the teams, the two items that would be a major part of the final course grade were emphasized: the executable plan of action and the formal investor presentation. It was suggested that the teams focus their effort and time on preparing and delivering a top quality executable plan of action and investor presentation, with each team member taking on a specific task. To insure that their projects moved forward in a timely fashion, the students were encouraged to spend more time interacting via email if they were finding it difficult to meet in person. Given the quality of the interactions of some of the teams during class time, however, it became obvious which teams still did not work on the projects outside of class, be it via email or

face-to-face meetings. These low performing teams also typically had incomplete team attendance in class.

Despite these “teething problems” typical of a novel pilot course, the classes ended very positively. This began with the students developing and presenting an elevator pitch of their product or service during week 11. Although the pitch was supposed to be 2:00 minutes long, the teams were allowed to go over time, as this was the first time most of them had engaged in such an exercise. The presentations lead to a lively exchange within the class about how to improve the pitches. In week 12, the student teams met with the mentors for the entire class and went over the penultimate draft of their executable plan of action. Finally, in week 14, the teams were asked to each present their executable plan of action in a twenty minute, in-class presentation. These presentations proved, for the most part, to be very interesting and well prepared. Furthermore, they generated a number of insightful and useful comments from the class members.

5.4 Student feedback

The students provided extensive feedback about the course as part of the regular end-of-term assessments and a synopsis of their comments is included in this section. The students liked the fact that one of the instructors had extensive experience with start-ups and entrepreneurship, “I liked how Dr. _____ was able to tell his old war stories; very much was learned from them,” and “Dr. _____ is awesome. This is the most real world class I have ever taken at State University.” The students also enjoyed how the course provided them with the independence and freedom to work through problems on their own commenting that, “I liked the freedom we had to explore the subject matter,” and “I enjoyed the opportunity to explore how my own business would be out in the real world.”

From the comments, it was obvious that some students still felt uncomfortable with the PBL format of the course, complaining about the lack of structure in the course saying that “the class needs more structured learning” and that “it was difficult to know what stage of development we should have been at as a group.” From these comments it is obvious that it was difficult for some students to understand that this ambiguity was built into the course and was part of the learning

experience. The students also suggested “perhaps a slower shift into the different style of learning” and that the course should “start with a textbook for (the) first couple of weeks, then let us go.” Statements like these indicated even students who want to be entrepreneurs (or at least learn about entrepreneurship) are totally accustomed to traditional learning format, and find the shift to PBL difficult. In spite of these concerns, a large number of students made a point of saying they would not change anything about the course and that we should “keep it the same” and even urged a similar “follow-up course which students could (use to) go to next level in their plan.” Perhaps the nicest comment was that the course was “among the most intriguing classes I’ve ever had. Thanks for the experience.”

5.5. Teaching team thoughts and observations

The overall consensus about the course was that it was a good first cut. As one of the teaching teams members commented when asked what he thought about the overall performance: “It could have been a complete disaster, so we did a pretty good job.” During the course assessment meeting it was concluded that one of the greatest problems was the lack of direct access to the web and the course content while in the classroom. Further, frustration was expressed about the fluctuating and low class attendance. Again, this varied by section; very few students in the second section missed a class. By contrast, in the first section, attendance was sometimes reduced to half the total class enrollment. It was also observed that the students in section one did not manage their course responsibilities well. Although it was clearly stated in the first meeting of the semester that the students would find all the material on-line—including the syllabus and weekly indexes that outlined that weeks activities—a statistical analysis of ANGEL use by the students showed they did not regularly access that material and read significantly fewer articles as the course progressed. It was concluded that this lack of attention to the on-line material meant the students were confused about when assignments were due and what learning activities they were responsible for. In addition, the students most likely realized that key new material topics were being covered in class, so they may have reduced their pre-class work time. It was also observed that the students did not participate in class discussions as much as would have been desirable. This lack of participation, it was believed, made it easier for faculty to slip into the lecture mode as a way to keep the class moving forward.

6. PROPOSED PLAN OF ACTION FOR COURSE IMPROVEMENT

In light of the student's comments and the above observations, the faculty and teaching assistants developed an action plan that will strengthen the course, increase the student participation, and further augment learning.

- Ensure that all future classes are run in technology classrooms, with computer projection and Internet and ANGEL access. It is imperative to always have access to the web and the on-line material so specific items can be pointed to as students raise questions and concerns.
- A significant part of the first day of class will be used to tutor the students on how to use the ANGEL course management system so they know where and how to find material and see what they are expected to read or review each week.
- The students will be required to develop team contracts for participation and assessments. These contracts will include a ranking system for participation at team meetings, clear requisites such as regular attendance at class as well as work on developing the business plan, and how the team will deal with lack of acceptable performance. The students will refer back to these contracts when engaging in peer assessments at the end of the class.
- The teams will be required to establish a regular meeting time outside of the classroom, be prepared to report on the each meeting's events in class, and tell the class facilitator the meeting time so there is a record of when the students intend to meet.
- The course will include on-line chat rooms for each team. By creating on-line chat rooms for each team it becomes easier for the teams to communicate in real time. Team meetings can be arranged in virtual space and this should facilitate greater interaction among team members who find it difficult to meet in person.
- The student teams will be asked to meet with the lead instructor at least twice per term, outside the classroom, to report on team process issues or problems.
- The timing of assignments will be revised. Given that this is an elective course, students will likely continue to sit in on the course and then decide whether to add the course after a couple of weeks. To minimize confusion about work that is due, a graded task will not be assigned until the third week of the semester.
- To increase attendance and class participation, more emphasis will be placed on the non-graded assignments for each week. During the first run through of the class, the student teams were not asked to present their work as they were moving through the modules. In the

future the first 40 minutes of the class time will be allocated for the teams to present their work in progress. Teams will be selected at random and the entire team will be expected to be ready to present that week's module to the class. If a team is not prepared or a team member is absent, points will be deducted from the team's or individual's overall grade. This approach will accomplish two goals: it will insure that the students are consistently working on their projects and it will make it harder for the facilitators to slip into "lecturing mode". The student's presentation time should take up the first part of the class while the second part of the class will be devoted to the teams meeting and working with the facilitator and teaching assistant.

- In order to address the student's concern about a lack of structure and the disconnect between on-line material content and class discussions, the learning objectives will be clearly outlined for each week during the first class of the term. Further, it will be emphasized that the students are to follow the on-line protocol when making decisions about what is to be done and when to do it. In addition, unambiguous metrics will be provided for each assignment so the students can develop a clear picture of what is expected of them and how they will be rewarded.
- Keeping in mind how popular Dr. _____'s "war stories" were with the students, a new series of videos will be added to the current video disc. This change will allow student's access to important and valuable material, will make better use Dr. _____ time, and it will archive these materials for future use and for easy distribution, analysis, and re-use.
- Faculty will adopt more of a facilitator's role, introducing timely materials and content of highest interest to the students (especially of the course is focused on a particular student group). That means the faculty will let the student team's activities rather than lectures drive the first half of the classes

7. RESEARCH

We are also carrying out an assessment study of the course to answer two questions:

1. Do BA/ENGR497G students (in one semester) experience positive changes in:
 - entrepreneurial self-efficacy
 - leadership
 - creativity
 - comfort with ambiguity

2. How do the BA/ENGR497G students compare in these traits to students in their capstone engineering and business classes (but are not enrolled in any entrepreneurship classes)?

The BA/ENGR497G students completed surveys in week 1 & 14 (pre- and post assessment), and some students participated in focus groups. The capstone students completed one survey at end of semester. The assessment tool uses the following scale:

- 1 = Strongly disagree
- 2 = Disagree
- 3 = Neither agree or disagree
- 4 = Agree
- 5 = Strongly agree

The preliminary results from students in the BA/ENGR497G course are being tabulated. Note that no students in the *Introduction to Entrepreneurship* course chose “strongly disagree” in response to any of the following statements.

- 95.7 % strongly agree or agree that “the course helped me to understand entrepreneurship”
- 90.1% strongly agree or agree that “the course is useful”
- 94.4 % strongly agree or agree that “the course is a good way to learn entrepreneurship”
- 88.7% strongly agree or agree that they “would recommend the course”

Comparison of student changes in the target skills and attributes (entrepreneurial self-efficacy, leadership, creativity and comfort with ambiguity) between the BA/ENGR497G and capstone course are being analyzed now. With these results, we will be able to compare the progress made by students involved in the class and see if there is a quantifiable difference in these students when compared to students not engaged in entrepreneurship instruction. In addition, the focus groups will provide us with candid observations about the course content and PBL process. The focus group students will be encouraged to help us determine both the strengths and weaknesses of our approach and how we can increase the effectiveness of the course. Overall, the study will help quantify the successes, failures and challenges of addressing the skills or attributes of entrepreneurial self-efficacy, leadership, creativity and dealing with ambiguity in the undergraduate college classroom.

8. CONCLUSION

A PBL on-line course for developing skills in entrepreneurship was successfully developed and piloted in Spring 2004. For many students, the *Introduction to Entrepreneurship* course was their first exposure to a PBL course with all course materials on-line or on videodisks, and with extensive use of the ANGEL course management system. While certain aspects of course delivery proved to be a struggle, 135 students have been engaged in a fruitful learning experience that may convince some of them to seriously consider starting their own enterprise. In addition, pilot testing the course provided valuable insights into the on-line PBL process in the realm of teaching entrepreneurship. Therefore, an action plan was developed for improving the course in order to better engage the students in PBL. The eleven-point action plan will be implemented as the course is run in successive semesters at the State University. The short term goal is to engage 100 students in each semester while also demonstrating the course to other faculty in various Colleges and Campuses throughout the State University system. In addition, a market research survey is being conducted to help determine how to attract other adopters throughout the “state” High School system (grades 9-12). Once the needs of the State University faculty and secondary school teachers in “state” has been established, development will begin on a computer-based curriculum to provide training for those faculty and teachers interested in adopting the course and helping students develop skills in entrepreneurship.

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APPENDIX A

Figure 1 – ANGEL Course Management Lessons Home Page

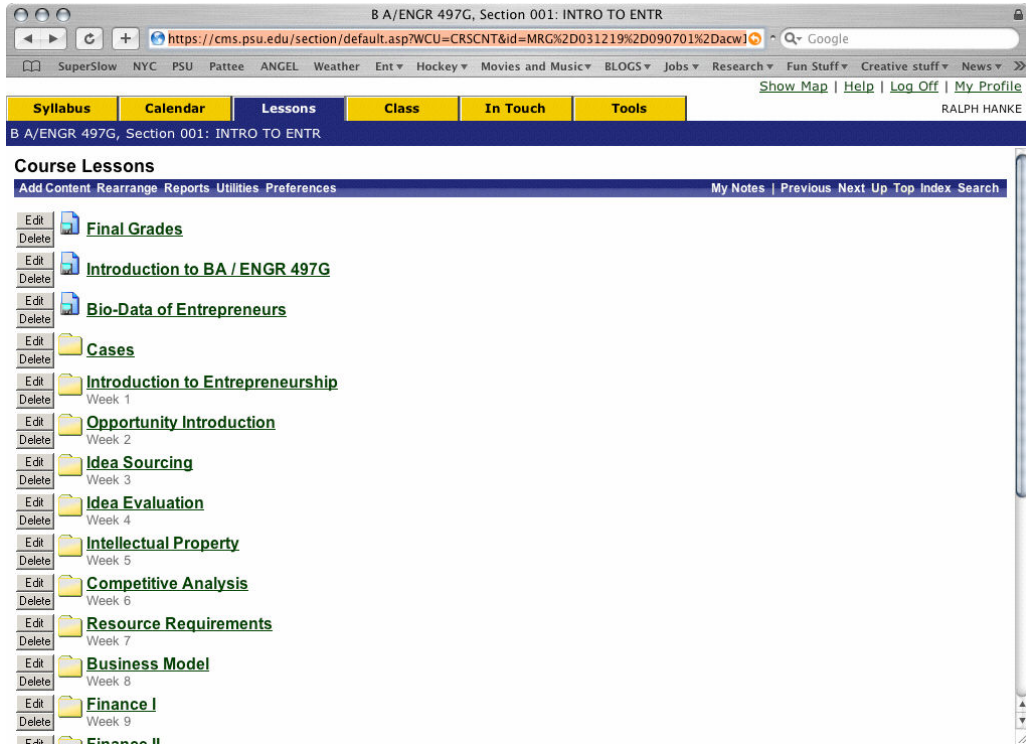
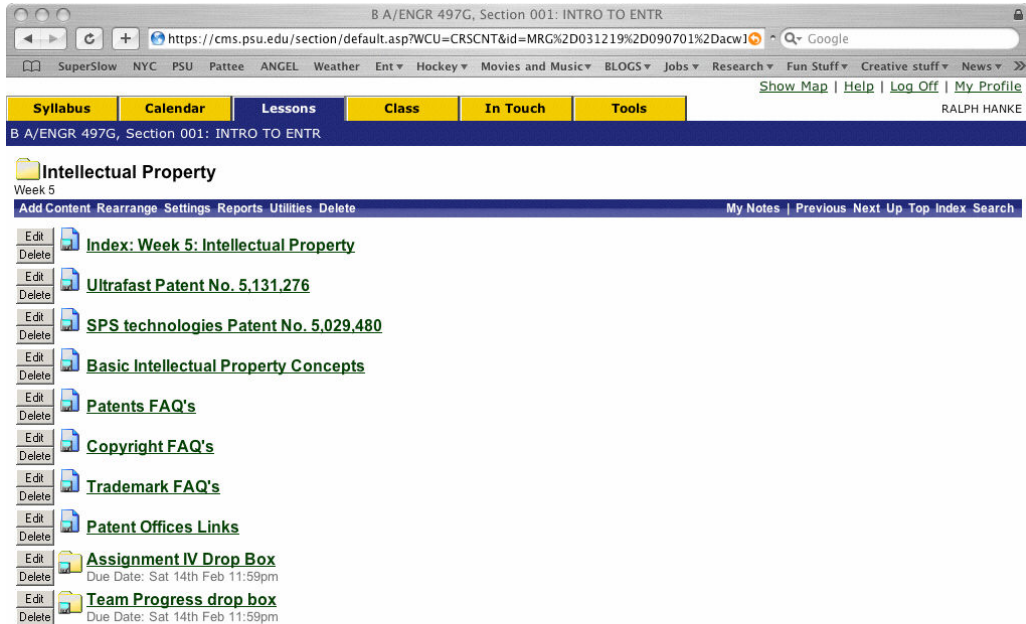


Figure 2 – Contents of Intellectual Property Folder (week 5)



[Home](#) | [My Profile](#) | [Log Off](#) | [Display](#)

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Figure 3 – Example of faculty support Tool in ANGEL

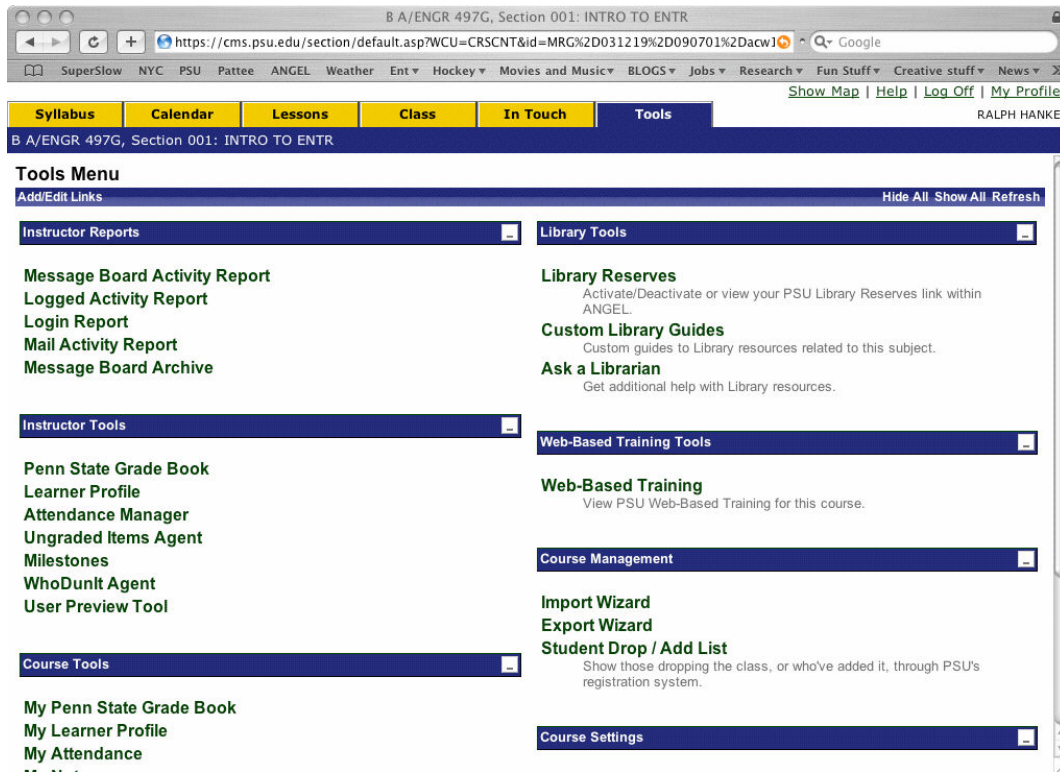
User	Postings	Replies	Total
AGARWAL , VIKAS	0	1	31
AGUIRRE ALVARADO, JORGE	7	1	31
ASHOOR , ABDULLAH	5	3	62
BECKOWSKI , BRIAN	10	0	62
BLAKE , HAYNESLY	14	8	91
BUCHHOLZ , KRISTIN	16	14	68
CARLONI, SHANNON	11	1	61
CHAUDHRY , USMAN	0	2	28
CHON , PETER	13	3	79
CONROY , CHRISTOPHER	5	4	67
DAMJANOVIC, PHILIPP	12	5	83
DELEWSKI, NICHOLAS	0	0	32
DOPSON , RYAN	3	0	40
DUNN , CHRISTOPHER	0	1	63
FARRELL, RENEE	9	1	46
FERRERI , KEITH	0	0	64
FORYS, JOHN	0	0	39
FOX, NICHOLAS	11	4	59
FRANTZ, KATHRYN	1	0	79

Figure 4 – ANGEL reporting of student on-line submissions

The following **students/members** have completed **Bootstrapping**.

#	Name	Username
1.	AGUIRRE ALVARADO, JORGE	JEA152
2.	ASHOOR , ABDULLAH	AGA110
3.	BECKOWSKI , BRIAN	BJB260
4.	BLAKE , HAYNESLY	HRB127
5.	BUCHHOLZ , KRISTIN	KEB259
6.	CARLONI, SHANNON	STC127
7.	CHAUDHRY , USMAN	UUC101
8.	CHON , PETER	PUC103
9.	DAMJANOVIC, PHILIPP	PXD188
10.	DELEWSKI, NICHOLAS	NED120
11.	DUNN , CHRISTOPHER	CED149
12.	FARRELL, RENEE	RAF218
13.	FRANTZ, KATHRYN	KMF215
14.	GILL , RUPINDER	RSG160
15.	KAITTANIS, CHARALAMBOS	CGK111
16.	LEE , MATTHEW	MSL181
17.	MANNES, EMILY	EAM244
18.	MCGLYNN, DANIEL	DXM333

Figure 5 – Home Page of Tools within ANGEL for faculty support



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