Implementing Technical Entrepreneurship as a Required Junior Course for all Students at Northwestern Lehigh High School

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Abstract
Futures II is a multidisciplinary, standards based, technology enabled graduation requirement for all eleventh graders at Northwestern Lehigh High School implemented in the spring 2003 and fall 2004 semesters. In this semester-long course, students create and run real businesses using a project based learning model and following Pennsylvania’s academic standards for career awareness and planning, career acquisition, career retention and entrepreneurship. Our primary goal at Northwestern Lehigh High School was to create a program that helps students meet the individual, family, work and community challenges in today’s complex, technology infused, global society. We offer this work as a possible model for others to follow. This course is a partnership with Lehigh University’s Integrated Product Development Program and Wilkes University’s Entrepreneurship Program. The Northwestern Lehigh model for entrepreneurship maps PA standards for career pathways onto the divisions of the startup company including a) arts and humanities mapped to design and marketing, b) business and communication to marketing and finance, c) engineering and industrial technology to production, and d) health and human services to human resources, safety, health and legal issues. Students form their own companies with president, division heads and team members. They search out product ideas; perform market research, product research and development. They identify their customers and market their products and /or services through the school’s morning TV show and fliers throughout the school and surrounding community. The company’s board of directors must pitch the idea to the faculty and administration, woo investors, develop their budgets, monitor cash flow, pay bills and disperse profits. This paper will describe the course, the course objectives and goals, the implementation, how administrative roadblocks were removed and describe the course assessment approach, the lessons learned and plans for the 2004-2005 school year.

Keywords: Standards, Entrepreneurship, Careers, Integration, Technology, K-12, Partnerships, Collaboration, Distance Learning, Problem/Product Based Learning

I. Introduction, Background and Rationale
A. Describe the initiative and educational partners.
In 2003 the Center for Advancing Partnerships in Education (CAPE), a consortium of K-20 educational and non-profit institutions in eastern Pennsylvania and western New Jersey, funded a joint project with Lehigh University in Bethlehem, PA and Northwestern
Lehigh High School [Ref 1]. This high school/university collaborative project included the development and implementation of an entrepreneurship-oriented, standards-focused, project-based learning experience required for all 200 eleventh grade students at Northwestern Lehigh High School. The courses use a multi- and inter-disciplinary, team-based, technical entrepreneurship approach to learning through the development of new businesses to create new products with the appropriate use of technology.

Northwestern Lehigh High School, accredited and approved by the Middle States Association of Secondary Schools and Colleges and the Department of Public Instruction of the Commonwealth of Pennsylvania, is situated in the northwest corner of Lehigh County, Pennsylvania. The school district, comprised of four townships, extends over 110 square miles, one-third of the total area in Lehigh County. The district has historically been predominately agricultural although more recently is expanding to a combination of professional, technical, and service-oriented workers representing all socio-economic levels. The comprehensive high school enrolls about 800 students in grades nine to twelve, with approximately 2400 students served in grade K-12. The district consists of one high school, one middle school, and two elementary schools.

Lehigh University is also located in the Lehigh Valley in Bethlehem, Pennsylvania, 60 miles north of Philadelphia, 75 miles west of New York City and about a thirty minute drive from Northwestern Lehigh High School. Lehigh University has four programs that have developed and implemented a collegiate level model that is used as the starting point for this high school initiative. These Lehigh University programs include the Integrate Product Development (IPD) program [Ref 2 and 3], the Design Arts (DA) curriculum [Ref 4], the Integrated Business and Engineering (IBE) major [Ref 5] and the campus-wide entrepreneurship minor [Ref 6-9].

B. Focus on standards
Aligning curriculum with the Pennsylvania State Academic Standards [Ref 10-13] continues to be the focus of an intensive curriculum review process that includes representatives of all stakeholder groups at Northwestern Lehigh. Futures II [Ref 14] was originally developed to solve the challenge of assuring that all students would meet the state graduation standards in Career Education and Work, Family and Consumer Science, and Technology Education. Previous to its implementation, student enrollments in courses related to these academic standards were entirely elective. Specific standards are now met by all students, regardless of career or postsecondary plans in the broad areas of career awareness and planning, career acquisition and retention, entrepreneurship, financial and resource management, balancing family, work, and community responsibility, food science and nutrition, child development, technology education, technology devices and science, technology and human endeavors [Ref 15-23].

C. Broad context of this initiative
Northwestern Lehigh School District has implemented a Career Education curriculum K-12 [Ref. 24-27]. Activities, developmentally appropriate for each grade level, are included beginning with awareness in Kindergarten and moving to selection of postsecondary schools, careers, or military options by twelfth grade. Implementation of
Pennsylvania Academic Standards and a Data-Driven Decision Model are becoming norm at the school. Final exams, linked to academic standards and course curriculum were re-implemented two years ago, after an eight-year lapse in this requirement. Data, collected in various forms, is analyzed to identify areas needing improvement. The mandatory Futures I and II courses, however, are the first to be designed using the required state standards as learning objectives. Technology is seamlessly infused in the Futures learning activities daily. Distance learning opportunities have expanded, with students and teachers connecting with sites throughout the United States and moving toward international partnerships. Internet 2 access was made available this school year and as a result new collaborative opportunities are being sought. Futures II students are working on planning committees for 2005 Megaconference Jr., “a new project, part of the K20 Initiative, designed to give students in elementary and secondary schools around the world the opportunity to communicate, collaborate and contribute to each other's learning in real time, using advanced multi-point video conferencing technology” [Ref 28]. Additionally, students at the high school are earning college credit through a variety of courses offered by videoconferencing, web conferencing, and on-line courses. All of these activities, in addition to the Futures program are designed to help prepare students for twenty-first century living and working. [Ref. 16-19]

D. Pedagogical and organizational underpinning
Public education has a long history of helping students attain the knowledge and skills needed to meet challenges of their contemporary society. In the twentieth century students needed skills to enter an industrialized workplace. In addition to the emphasis of basic skills called for in the No Child Left Behind legislation, students in the twenty-first century workplace need skills to identify, organize, plan, and allocate resources; work with others in diverse teams, assuming leadership roles; acquire and evaluate information; understand the complex interrelationships that exist in a global society; and work with a variety of technologies, while displaying creative intellectual curiosity, and self-directed problem-solving. Computer technology and information access has quickly become an integral part of our everyday lives- at home, at work, and at play. It only makes sense that public education addresses the interaction of our new environment abundant with informational technology, and the individual. [Ref. 16-22] Our goal at Northwestern Lehigh High School was to create a program that helps students meet the individual, family, work and community challenges in today’s complex, technology infused, global society.

Northwestern Lehigh was faced with the task of developing a course that would meet several objectives.
1.) As a result of curriculum mapping, we came to realize that several disciplines were overlapping within the curriculum (e.g. consumer issues, financial literacy, resume writing, etc.). In light of the hundreds of standards that are being required for graduation, we do not have the luxury of duplicating learning activities.
2.) Each year, seniors complete an evaluation survey of their high school education. Consistently, our high school has earned low scores in the area of career preparation. Between the graduating classes of 1999 to 2004, 54% to
67% of seniors surveyed reported that they would have benefited from more emphasis on career education and options available after high school [Ref. 23]. Career education and preparation has been done haphazardly, almost as an add-on or afterthought in various courses, but there was no intentional plan to include career education for all students. Our school joined a newly formed county-wide Career Pathway Consortium in 1998 and determined career education needed to be imbedded in courses for all students. Through our curriculum review process, we developed the Futures program as an answer to this problem. Futures I, required for all ninth graders was implemented in 2001-2002 and provides a foundation to the knowledge and skills identified in the standards. Futures II, phased in for the 2003-2004 school year, utilizes an entrepreneurial model as the means to imbed the standards and ‘twenty-first century skills’. In this model, students explore and eventually choose a focus from four career clusters- Arts and Humanities, Business Communications Technology, Engineering/Industrial Technology, Health and Human Services, and from two pathways- Traditional Academic or Technical Academic. Using the model as a guide, students begin to understand their strengths and interests as they prepare for their future.

3.) With the adoption of new regulations in Pennsylvania, all students must meet the identified academic standards. Courses that could help students meet these standards were previously all elective. Instead of protecting “turf”, we decided to collaborate and create a team approach. After restructuring departments we created a new “Career and Technology Department” comprised of Family & Consumer Sciences, Business Education, and Technology Education, three disciplines in which we saw common themes and an occupational focus that prepares students for “real life” through practical knowledge, skills, and habits. We set out to create required integrated courses in which all students would meet the standards.

4.) Research in education and brain development has identified successful teaching strategies to help students learn and retain more knowledge and skills. SCANS and Partnership for 21st Century Skills [Ref 15, 16] have identified skills employees need to succeed in the ‘new’ workplace. Interestingly, these skills correspond with those family members need to be successful. We designed the program to be fast-paced with many hands-on activities. We planned to differentiate instruction to meet the needs of all students while putting into action all that we know defines excellence in teaching and learning. [Ref. 20-21]

Entrepreneurship education embodies all of the components identified: communication and technology skills, financial literacy, problem-solving and critical thinking, real-world experiences and assessment, global connections, and higher-education and business partnerships. Modeled after Lehigh University’s Integrated Product Development (IPD) and other programs, Futures II uses an entrepreneurial approach as students learn the processes involved to be successful in their future endeavors. The process and the course follow the phases as outline below in Figure 1. The phases include the development of
the opportunity, the concept design, the parallel development of the product, the manufacturing and the marketing, the product launch and the exit strategy (not shown).

![Diagram of New Product Development Process]

**Figure 1. New Product Development Process**

### II. Description of the Future II Course

Futures II is taught in 80-minute periods every day for one semester. Each semester is eighteen-weeks in length. Futures II is an integrated course, involving concepts from many disciplines including Business Education, Family and Consumer Sciences, and Technology Education. Modeled after Lehigh University’s Integrated Product Development program, it is designed to help students plan for careers and opportunities that await them in the world of work, and take steps to meet personal post-secondary educational and career goals. Students learn the basics for managing many aspects of adult life including making deliberate decisions and setting goals; managing time, finances, housing and other resources; skills needed to acquire, maintain and advance in careers; communication skills for team work and positive conflict resolution; maintaining healthy life styles; balancing family and work responsibilities; and exploring the impact of technology on individuals in their family life and the workplace. Futures II focuses on entrepreneurial and problem-based learning as a means to apply skills and processes that lead to successful families, communities, and careers. The course includes many hands-on activities and the extensive use of technology.

The all entrepreneurial projects include:

1. Product Research and Development
2. Market Research
3. Company formation and name
4. Approval Presentation
5. Operations: setting goals, evaluation and revisions

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Each company is unique but includes an organization structure that is appropriate for the business. In the Northwestern Lehigh Model, each company includes a board of directors made up of faculty, administrators and graduate student interns, a president, and an executive team with department Vice Presidents. Team members are assigned to each department. Departments within a typical company include: Design (graphics and web), Marketing, Production, Human Resources, Finance, Legal (including health and safety) and others as needed. These departments coincide with the Career Pathways as shown in Figure 2.

More specifically, during the entrepreneurship start-up section of the course, students apply into a department according to their career interest. Additional departments are added depending on student career interests and needs of the specific business. Students submit a cover letter, resume, and completed job application to apply to the department of their choice. They participate in an authentic interview. During the interview, each student must make a clear connection between his or her career aspiration and the department to which he/she is applying. After being ‘hired’ to their department, students research their areas of interest and collectively propose and then create a business. After marketing surveys are conducted with the student body, the marketing department quantifies the data collected, and based on this data, the business is started.

As an example, one of the student ideas for a business was to sell nutritional juice smoothies to the student body during first period each morning. Team members used the SMART Board as shown in Figure 3 for brainstorming ideas, presentations, or capturing notes. This piece of technology is used in place of the traditional chalkboard to allow for student interaction and to save and print their data. A variety of departments within the businesses use the SMART Board to update the class on the progress of the business.
Figure 3. Team members captures ideas on the SMART Board- Phase 1.
Technology used includes the SMART Board, wireless laptop and an LCD projector. Figure 4 shows the Marketing Department creating a commercial to be played on the morning TV show- Tiger News. Technology used includes a digital video camera, computer, AVID (software for video editing), VCR, DVD recorder/player, TV, and PowerPoint to broadcast the final commercial to the school during the morning announcements.

Figure 4. Video taping of the morning commercial for smoothies- Phase 2 & 3

Pictured in Figure 5, a team member pitches the product idea to the High School Principal for final approval to sell smoothies. Smoothies were approved and the name chosen for this business was “Smooth Ease.”
In Figure 6 above, students are working on their web page for the business and the TV advertisements that appear daily in every classroom at the school. Web page development is requirement for all Future II businesses. Each team must contribute departmental information for the web site. For example, marketing will add coupons and bonus offers, whereas the health department will post the Nutrition Facts. Technology used includes a wireless laptop, digital camera, scanner, and web page software (FrontPage, Word, HTML coding).

In Figure 7, students are experimenting with taking orders on hand held computers. Students work to explore different ways their business can benefit from using this technology. Students also use the hand held computers for presentations using MArgi Presenter to Go software. Technology used includes Palm and Dell pda’s, LCD projector, wireless laptops, and a variety of Software (Excel, Power Point, MS Word).
As shown in Figure 8, production must deal with real world issues of facilities, personnel, ordering of ingredients, producing the smoothies, delivering the final products to the customers while following health and safety standards.

After all the planning and research, the students are happy to see a profit. The finance department is responsible for determining the “bottom line” for each endeavor including the costs of materials, personnel, outsourcing, marketing and advertising, fees and overhead. Progress report on cash flow and final end-of-semester profits are produced.

Future II business operation projects have included the creation of Photo I.D cards, advertisements, improved procedures/policy handbooks for the business, color coded maps of the school for deliveries, stockholder cards, menus, surveys, order forms, business cards, and much more.
Northwestern Lehigh School District financed the start-up costs for this course. A SMART Board, wireless cart with fifteen laptop computers, laser printer, and LCD projector were purchased from the district technology budget. CAPE (Center for Advancing Partnerships in Education) awarded Northwestern Lehigh a $24,695 grant to help implement the program. The funds covered telecommunication costs including Internet 2 connection and the shared license for Cyber Grad- the web-conferencing platform; web cams, and headsets with microphones; stipends for the graduate assistant and university mentors at Wilkes University; travel expenses for high school students to attend presentations by Lehigh University’s IPD students; curriculum development stipends for the teachers involved; a color printer and two handhelds and related software. Four additional handhelds were purchased with a $2000. PA Dept. of Education mini grant supporting High Schools that Work initiatives. Start up costs for the businesses were supplied by the school district with the purchase of food and craft supplies, small kitchen appliances such as smoothie machines, coffee makers, a small refrigerator and blenders.

Student business profits after all expenses for the first year netted over $1,500. As an exit strategy (Phase 5 – not shown in Figure 1), the companies were dissolved and the students voted to provide over $500 for start up costs for the following year and $1000 was deposited into the Class of 2005 funds to help finance the senior prom.

III. The Role of Technology to Assist the Curriculum
Technology is integrated throughout the Futures II course. Students use:

- **Choices and Career Cruising** software programs – Career planning, post-secondary comparison, demographic predictions for possible employment
- Wireless Laptops (15- classroom set) & Computer Lab (30)
- Office Suite software– Word, Excel, Power Point, Access, Publisher, Front Page for all assignments
- Food Processor software –created by ESHA Research for nutritional analysis and food labels
- MS Money software for financial record keeping
- Digital cameras, video editing (Avid), scanners, LCD projector unit, SMART Board, and WiFi handheld units for daily assignments, marketing strategies, presentations to stakeholders, and brainstorming sessions.
- Classroom Performance System – infrared interactive response system for instant feedback on pre-post assessment or surveys with analytical data
- IP and ISDN videoconferencing and web-conferencing with the CyberGrad-Learnline platform for live, interactive collaboration with higher education mentors and business consultants.

Pictured below in Figure 9 is the CPS (Classroom Performance System). This system is used for pre-and post assessments. It allows students to beam their responses to the infrared receiver, which generates instant data for evaluation of student knowledge, quality of instruction, and analysis of the assessment tool. Technology used: the CPS system, LCD, wireless laptop, and SMART Board.
All Futures II classes use videoconference and web conferencing on a weekly basis as shown in Figure 10 and 11. This technology has been implemented into the curriculum for the 2004-2005 school year and allows the team to interact with mentors and advisors outside of the school. Futures II has been working with Wilkes University and their Entrepreneurship Program. Wilkes has assigned two college students to every Futures II class. The Wilkes students are part of the business “Board of Directors,” who meet every Tuesday using one of these technologies. The President of the business has an agenda for every meeting. Technology used: wireless laptop, TV, video camera, videoconferencing hardware/software, CyberGrad-Learnlinc, and head sets with microphones for communication purposes. Students use a wide range of software including:

- Microsoft Office -Word, Excel, PowerPoint, Access, and Front Page
- Microsoft Publisher
- Career Cruising (web based subscription)
- Building Homes of Our Own
- 3-D Home Architect
- Page Maker
- My Decisions (web based subscription)
- The Business Disc
- Avid (for video editing)
- Adobe Photoshop
IV. Assessment Methods and Results

The overall goals of the Future II courses map directly on to the PA academic standards in 1) Career Education and Work including career awareness (exploration), career acquisition (getting a job), career retention (keeping a job) and entrepreneurship; 2) Family and Consumer Sciences including financial and resource management, balancing family work and community responsibilities, food science and nutrition and child development; 3) Science and Technology including technology education, technological devices, science, technology and human endeavors. Assessment is based on 1) authentic measures, 2) the use of rubrics common to all projects, 3) standards for both the projects and content, 4) exit interviews [Ref 23], and 5) SCANS’ higher order observable behaviors.

Futures II use authentic assessment strategies. For example, all projects and assessments are geared to better prepare students for the “real world.” This class tries to provide a hands-on learning experience in which every student can benefit. Futures II provides students with real-life applications therefore, assessments are authentic. For example, students go through an interview process to get hired into a department within the Entrepreneurship section of the course. Administration, teachers, staff, college mentors and community members conduct the interviews. Students are required to have a completed job application, cover letter, resume, and references; dress appropriately; and are graded using an interview rubric that a potential employer might use for the interview process. Throughout the entire Entrepreneurship section of the course, students are assessed on their performance. Each department, as well as each student, is assessed. Departments evaluate each other on a weekly basis. This encourages students to work toward and surpass their departmental goals. Students are also assessed on authentic activities that are provided throughout the course. Some activities include, but are not limited to business card design, business plan creation, ethical cases, and SWOT analysis of their own business and other businesses.
V. Lessons Learned, Conclusion and Next Steps

It has been a challenge to help some students to value this real-life application. Students have been immersed in a traditional educational system focused more on ‘grades’ and less on ‘learning.’ Because this course utilizes authentic project(s) and hands-on application rather than lower level thinking skills, some students have a hard time adjusting. During the first semester, we learned that college bound students wanted to spend more time in the career/postsecondary comparison section of the course, while others found less value in this area. Consequently, we differentiated instruction, providing more student choice while expanding our resources so that students are provided individualized opportunities to explore and plan for their educational and career goals. Another lesson learned was that we needed to implement the entrepreneurship section earlier in the semester. We identified standards that could be met through the business formation rather than as stand-alone lessons. This enabled us to implement the business earlier, giving students more time to plan, market, make and sell a product or service.

A roadblock that occurred initially, dealt with setting up accounts and managing money. After meeting with the district business manager, we were informed of many laws, policies, and procedures that prevented us from implementing our original plan. For example, we wanted considered paying students $0.50 for every day of “work.” Paying students violated minimum wage and worker’s compensation laws. We wanted to sell real stock to students and interested investors. Again, this was prohibited by school district policies and non-profit school status. Instead, the students created a stock simulation selling shares and paying dividends with paper money. We planned to set up a class checking account at a local bank in order to make supply purchases easier rather than using district purchase orders or charge accounts. We learned this also went against district policy. Setting up an individual Futures II account within the school was prohibited as well. Again due to district policies, Futures II would have to be considered a ‘student activity’. If it were considered a ‘student activity’, the school would have to pay an advisor. If the advisor would do it for free, the teacher’s union could get involved. This seemed like a no win situation. We decided to work the finances through an existing student activity account that was already established within our department. So far, this has worked well. Futures finances are easily tracked within the account using Microsoft Money. We will continue to address any problems that we may be faced with in the future with an entrepreneurial spirit that will not focus on the million reasons why we can not do something, but focus instead on work with all involved to find creative ways to get it done!

Futures II has came a long way in the first year of delivery. We took the lessons learned and adjusted to ensure an improved teaching and learning experience. We hope to keep making future connections with business, colleges, and universities. We look forward to implementing more technology as it becomes available. We will continue adjusting lessons and assessments to better prepare our students to fit the expectations of the “real world.”
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**Author’s Biographies**

**Bryan Klass** is the teacher the Futures II, a required eleventh grade course at Northwestern Lehigh High School. He holds a B.S. in Education with PA Certification in Business/Computer/Information Technology from Delaware Valley College, and is working toward a M.S. in Educational Leadership through Wilkes University. Bryan, in his third year teaching, previously taught one year at Palisades High School in Kintersville, PA. While there, he created an Entrepreneurship course rich in problem-based learning and technology integration. He has also served two summers as Head Teacher at Northampton County Juvenile Justice Center. Bryan was awarded a 2003-04 Keystone Innovators Award from the Pennsylvania Department of Education for his work integrating technology into his classroom.

**Leah Christman** is Instructional Technology Facilitator and Career and Technology Department Chair at Northwestern Lehigh School District. She has been a public school educator in Pennsylvania for 26 years. She holds a M.S. from Bloomsburg University of Pennsylvania and Pennsylvania certification in Family & Consumer Science K-12, Vocational Supervisor, Instructional Technology Specialist, and is near completion of
California University of Pennsylvania’s Administrative Principal’s Program. Ms. Christman was honored as Pennsylvania Family and Consumer Science Teacher of the Year in 1998 and Partners in Distance Learning Educator of the Year Award in 2003. She has served on numerous committees at the Pennsylvania Department of Education, including the steering committee that developed the PA FCS academic standards.

John B. Ochs is Professor of Mechanical Engineering at Lehigh and Director of the Integrated Product Development Program (IPD), which he co-founded with Dr. Watkins in 1994. He is the past chairman the Entrepreneurship division of the American Society for Engineering Education. From 1985-95 Dr. Ochs did extensive industry consulting and was involved in the start up of three companies. In 1996 the pilot courses IPD won the American Society of Mechanical Engineers’ curriculum innovation award and in 1997 IPD won the Newcomen Society award for the promotion of America’s free-enterprise system. Dr. Ochs holds a MS and Ph.D. from The Pennsylvania State University.