

Integrating Engineering, Design Arts and Entrepreneurship Education through New Product Development Projects

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Abstract – The purpose of this paper is to describe and solicit critique of our experience in implementing a Design Arts program, created from scratch and integrated with established engineering departments. Lehigh’s new Design Arts program requires foundation courses in both design and art and advanced courses in several areas of concentration including graphics design, product design, digital imaging and web design. This paper focuses primarily on Product Design and its interface with Mechanical Engineering and Lehigh’s award-winning Integrated Product Development (IPD) Program. Highlighted throughout the paper are the roles of 1) industry projects, 2) highly interdependent interdisciplinary teams of students from engineering business and design arts and 3) state-of-the-art technology, particularly the hardware and software provided by Lehigh’s PACE grant along with how these tools are used in both the Mechanical Engineering and the Design Arts curricula. The paper concludes with the assessment approaches used to evaluate the impact of our efforts, the lessons learned, as well as how we hope to continue to improve.

Keywords: design arts, engineering, entrepreneurship, IPD

BACKGROUND

Institutional Setting

The 1,600 acre campus of Lehigh University is located in Bethlehem, PA, 75 miles west of New York City and 50 miles north of Philadelphia. The university is private, co-educational, non-denomination and serves 4,650 undergraduates and 1,980 graduate students with ~60% percent male and 40% female. Students are enrolled in 3 undergraduate colleges: arts and science (50%), business (20%), engineering (30%) with a graduate college of education. Lehigh is considered to be in the class of “highly selective” schools with a combined SAT scores ranging from 1210 to 1350 with over 50% of the student body receiving scholarships. The student body is from over 20 states and 65 countries with the majority of students coming from Pennsylvania, Delaware, New Jersey and New York. There are approximately 400 full-time faculty members with an 11:1 undergraduate student to faculty ratio. The University is a class R2 research school with annual research funding of \$35-37M with 24 research centers or research institutes. Lehigh has an active and engaged alumni serving in various capacities, such as industry liaisons, department and program advisors and members of the University Board of Trustee.

The Academic Setting

A key differentiating characteristic of a Lehigh University education is the opportunity for students to work in interdisciplinary teams on integrated projects from industry sponsor. Each undergraduate college, The PC Rossin

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College of Engineering and Applied Science, the College of Business and Economics and the College of Arts and Sciences, give students this opportunity in a variety of innovative programs that require cross disciplinary teams. As is the case with most engineering programs who seek accreditation from ABET (the Accreditation Board of Engineering and Technology), there is a capstone design sequence of courses in which students engage in open ended, professionally oriented and team based industrial projects. At Lehigh University these interdisciplinary projects are organized under the Integrated Product Development (IPD) Program and are supported by the IPD program's staff and the Wilbur Powerhouse, a 17,000 sq ft facility designed for team projects and shared by other interdisciplinary programs such as Integrated Business and Engineering (IBE), Computer Science and Business (CSB), the Entrepreneurship Minor and the Design Arts Program.

The development of the Design Arts program in the College of Art and Science followed an evolutionary path using the capstone engineering courses as both the rationale and test bed for our development effort. Industry projects were introduced into these capstone courses in a 1995 pilot. Interdisciplinary teams of engineering and business students were introduced in 1996 and these identified the real need in new product development for aesthetics and ergonomics which was added in 1997 via outside speakers and consultants. From 1998 to 2001 the curriculum development continued with the piloting of experimental courses in color theory, proportional systems, sketching and rendering and the eventual design and implementation of a new Design Arts curriculum. The Design Arts program was first proposed in 2001 as part of a campus-wide initiative to create new innovative, technologically-oriented majors. The full program with majors and minors was ushered through the university approval process in academic year 2003 and officially launched in September, 2004.

The most recent addition to these innovative interdisciplinary programs is the entrepreneurship minor. Housed in the College of Business and Economics, the minor program is designed so that any undergraduate student can participate. The five course sequence includes Economics, Entrepreneurship 1 and 2 which are lecture and case study courses followed by Entrepreneurship 3 and 4 which parallel the capstone project courses where the industry sponsor is replaced by the student entrepreneur. The student e-teams compete for funding through the NCIIA grant programs. For the past seven years, Lehigh has won nine e-team grants resulting in the development of several new products, patents and the formation of Limited Liability Corporations (LLC) housed in the Wilbur Powerhouse.

Industry Interactions

The vast majority of IPD projects are sponsored by established companies. Since 1995 there have been over 150 industry sponsored projects. Company sponsors have included Fortune 500 companies down to one or two person start up companies. Each summer and fall participating companies provide a list of potential projects which are reviewed by the IPD faculty and staff. The projects are chosen based on their size and complexity (Can the student team do it?), their interdisciplinary nature (Will it engage business, design arts and engineering students?), how committed is the company to the project? We prefer back burner projects that are 3 to 5 years away from the normal product development cycle. In addition to projects we require the commitment of one half day per week of an industry mentor to work with the students and be available for questions and answers, particularly with regards to the business and market research components of the project. This information is critical to allow the student team to put the project in the correct business and market context. Industry sponsors also provide the students with funding. We charge our industry partners \$5,000 per IPD team with \$2,500 going to direct support and the remaining going to support the program and lab overhead.

The PACE Program

In February 2005, Lehigh was admitted into the PACE program, however our relationship with the PACE companies dates back many years and it is expected to continue to grow. General Motors has been one the IPD Program's most consistent and popular project sponsors. For the past 5 years GM has support one or more teams each year including an end of semester trip to Detroit for the team's final presentation. GM has a history of support for Lehigh going back to the Packard Laboratory the main engineering building built in 1929, which houses the Department of Mechanical Engineering and Mechanics (MEM), the GM Packard Auditorium, the MEM Engines Lab as well as the first Packard Automobile from 1899 under protective glass in the lobby.

Lehigh's relationship with the other PACE companies is more recent. In 1980 Lehigh's Mechanical Engineering and Mechanics Department's Computer Aided Design Lab purchased its first license for Unigraphics as a beta test site running on a VAX 11-780 with ten green-screen, refreshed CRT terminals. We have come a long way since then. Twenty five years later, Unigraphics and I-Deas are still the primary CAD/CAM and CAE packages imbedded in the undergraduate MEM curriculum with the software running on over 50 workstations in several labs. In addition from 1993 to 1995 Professor Ochs was the Chairman of the Unigraphics User group and in 1999 during a sabbatical in Detroit, Professor Ochs worked with the folks at EDS's training facility participating in their professional development courses in Manufacturing Enterprise Leadership (MEL) and Integrated Product Development (IPD).

With this background and history, the faculty leaders in Design Arts, Integrated Product Development and Entrepreneurship are creating a unique confluence of courses and educational activities that we believe represent the future of integrated, cross disciplinary, experiential education.

DESIGN ARTS PROGRAM

In the fall of 2004 after four years of developing pilot courses, the efforts of several dedicated faculty resulted in the approval of a new major in the College of Arts and Sciences called Design Arts [Ref 1,2,3]. By design, this program is administratively associated with the Department of Art and Architecture but housed in the Wilbur Powerhouse and Wilbur Annex. The program has a full time director, Professor Anna Chupa and an advisor group with faculty from business, engineering, computer science, the humanities, art and architecture and theater.

Design Arts offers a Bachelor of Arts degree in Design Arts and minors in graphic design, product design, digital imaging and web design. The BA in design arts is 121 credits; which includes the liberal arts distribution requirements from the College of Arts and Sciences and 48 credits within the major. Courses in the major are both program-specific and cross-disciplinary with the expectation that majors will experience both breadth and depth in their design experiences. Students declare a concentration in one area (graphic design, product design or digital imaging) and complete the remaining course of study with guidance from the program director. The major is structured to include four sequences: media skills, theory, history and intellectual context, and concentration, while the minor includes sequences in a) foundation courses, b) theory and history courses, c) courses in one of the four areas of concentration. For the purpose of this paper, the design arts minor will focus on only one of the four areas of concentration, that being product design⁴.

Design Arts Minor in Product Design

The Design Arts minor requires six courses with two foundation courses, one theory or history course and three courses in the area of concentration. The foundation courses for all four areas of concentration in Design Arts include three courses, Design Foundations I, Design Foundations II and Digital Foundation. The catalog descriptions of these courses are as follows:

DES 3. (ART3) Design Foundations I (3) An introduction to the basic elements and principles of design. The course involves use of various materials to solve 2-D design problems in studio and computer lab. Required of all majors in department

DES 4. (ART4) Design Foundations II (3) An introduction to the basic elements and principles of design. The course involves use of various materials to solve 3-D design problems in studio and computer lab. Problems solving in variety of materials for 3-D design including assemblages, models, construction and conceptual forms. Required of all majors in department.

⁴For more information about the courses and sequences for the Design Arts major and all four areas of concentration, please refer to the Lehigh University catalog or contact Prof Anna Chupa, the Design Arts program director.

DES 5. Digital Foundations (3) Introduction to a variety of 2-D and 3-D software applications for digital design. Students will acquire a basic understanding of digital image manipulation, graphics layout tools, 2-D CAD techniques and 3-D renderings.

Multiple sections of these foundations courses are offered each semester with a target maximum class size of sixteen students. This class size insures the availability of shop, studio and computer lab space for intensive individualized hands-on experiences with a variety of technologies, methods, machines and materials. The three foundation courses along with one other elective course make up the media skills sequence. For product design minor only two the three courses are required. For the minor minimum of one course is required in the theory and history sequence while it is required that majors take five courses in theory, history and intellectual context. The product design theory sequence includes:

DES 60 Design Process (3) Students will study how an idea becomes a final design by analyzing their own actions and role designers play in the development of products, graphic design (online and print), and time-based media.

DES 66 Design History (3) History of product design, graphic design and time-based media in artistic, cultural, technological, and business contexts.

DES/ART 68 Color Theory (3) Applications of color in design. Color in graphics, product, digital imaging, and all related fields of design.

DES 164 Ergonomics (3) Introduction to physical, emotional and psychological ways design interacts with people. Analyze real design problems and create solutions.

DES 266 History of Contemporary Design (3) History of modern design from mid 19th century to the present. Studies and discussions of contemporary issues and technology in Design Arts. Topics will include green design, digital technology, current legal and ethical principles and other issues.

DES 366 Case Studies in Design History (3) History of design. Study of specific products in context with regards to their impact on art, culture and technology.

Three courses are required for the minor in design arts with a product design concentration. These include:

DES 40 Product Design I (3) Introduction to the field of Industrial Design. Through the reverse engineering of existing products and analysis of these artifacts with drawings and modeling, students will acquire an understanding of the various aesthetics, technological and business issues a designer must consider when creating a product. Computer modeling, milling to rapid prototyping, three dimensional design projects. Prerequisite DES 3

DES 140 Product Design II (3) Intro to manufacturing and materials for the industrial/product designer. Model making and investigating the interactions of the product and the application. The emphasis on user centered design. Students will create original product designs, developing proficiency in various traditional and virtual visualization techniques and learn about product styling. Prerequisite DES 40

DES 240 Product Design III (3) Development of products with emphasis on innovative ways of understanding the role of objects in people's lives. Prerequisite DES 140

DES 211 Integrated Product Development (IPD) I (3) (Co listed under BUS 211 and Engr 211) Business, engineering and design arts students work in cross disciplinary teams of 4-6 students on conceptual design including marketing, financial and economic planning, economic and technical feasibility of new product concepts. Teams work on industrial projects with faculty advisors. Oral presentations, written reports. Prerequisite Junior standing.

DES 212 Integrated Product Development (IPD) II (2) (Co listed under BUS 212 and Engr 212) Business, engineering and design arts students work in cross disciplinary teams of 4-6 students on detailed design including fabrication and testing of a prototype of a new product developed in IPD I. Additional deliverables include a detailed product plan, marketing plan, detailed base-case financial models, project

and product portfolio. Teams work on industrial projects with faculty advisors. Oral presentations, written reports. Prerequisite DES 211.

The selection of the six courses that make up a minor in Design Arts with a product development focus can provide the engineering or business student with the background and basic skill set to differentiate themselves from others in their major and these skills often complement the skills development within their own majors. For example a mechanical engineering student with background in the mathematics skills to model, predict and simulate thermal, fluids or mechanical systems, the design arts minor adds the ability to sketch, create a CAD model and create mock ups and prototypes incorporating an understanding of aesthetics and ergonomics.

ENTREPRENEURSHIP MINOR

In the fall of 2004, the joint faculty committee proposed to offer a co-sponsored (business college and engineering college) minor in entrepreneurship with pilot courses beginning in the spring semester, 2005. [Ref 4,5,6,7] The minor will consist of five courses totaling 16 credit hours as follows:

1. Eco 1: Principles of Economics (4 credits)
2. Entrepreneurship I: Managing Discovery for Wealth Creation (3 credits)
3. Entrepreneurship II: Entrepreneurship and Enterprise (3 credits)
4. One of the following options (3 credits)
 - o Entrepreneurship III: Entrepreneurship Practicum, "The Garage"
 - o Integrated Product Development (IPD) Capstone Projects I
 - o Integrated Business and Engineering (IBE) Capstone Projects I
 - o Lehigh University Management Assistance Counseling (LUMAC)
 - o Or other independent, experiential and team project approved by the minor program director.
5. Entrepreneurship IV: Launching Entrepreneurial Ventures (3 credits)

The catalog descriptions for these courses are as follows:

Economics 1. Principles of Economics (4 credits, fall, spring or summer). A one semester course in the principles of economics. General topics include: supply and demand; pricing and production decisions of firms; role of government in the economy; the determination of national income; money and banking; monetary and fiscal policy; and government finance.

ENSP 101. Entrepreneurship I: Managing Discovery for Wealth Creation (3 credits) Introduction to the nature and process of entrepreneurship. Particular emphasis on identifying and seizing entrepreneurial opportunities, on creativity, innovation and vision, and on the process of pursuing those opportunities beyond resources currently controlled. Topics include: alternative concepts of entrepreneurship; personal attributes of entrepreneurs; steps in new venture creation; introduction to entrepreneurial finance and marketing in severely resource-constrained environments; intellectual property; new venture business planning for both emerging and existing enterprises. Uses case studies, cross-functional student teams, and exposure to successful entrepreneurs through guest speakers. Prerequisite: Eco 1.

ENSP 201. Entrepreneurship II: Entrepreneurship and Enterprise (3 credits) Investigates skills and steps necessary for entrepreneurial success: the entrepreneurial mindset; entrepreneurial opportunity scanning and screening; informal networking and finding and managing external resources; managing risk by sequential commitment; developing entrepreneurial marketing plans; entrepreneurial sales; family, friends and angel investors, debt and venture capital; horizontal management and developing an entrepreneurial leadership team and creative culture; technology cycles; structuring the new venture; managing change and rapid growth; ethics; exit strategies. Includes articles, case studies and original research. Cross-functional team-based experiential practice of these skills and discussions with successful entrepreneurs are integral parts of the course. Prerequisite: ENSP I or permission of minor program director.

ENSP 211. Entrepreneurship III: Entrepreneurship Practicum, “The Garage” (3 credits) Students work in cross-disciplinary teams of 4-6 students with faculty advisors and alumni mentors on marketing, financial planning and business and technical feasibility of entrepreneurial products or service concepts. Students may elect to work either on projects related to Lehigh University intellectual property, or ideas brought in by outside entrepreneurs, or on their own entrepreneurial projects. Oral and written presentations and discussions with guest speakers are integral parts of the course. Prerequisite: at least junior standing and ENSP II or permission of minor program director.

ENSP 212. Entrepreneurship IV: Launching Entrepreneurial Ventures (3 credits). Investigates in detail the critical steps and activities necessary when entrepreneurs seriously considering starting their own businesses. Organizational structure, governance and legal forms of business. Advisory boards. Business and product liability. Intellectual property protection. Sources of capital, establishing credit, seeking angel investors and venture capital. Writing and circulating the Venture Profile. Generating and defending financial projections, revenue streams and expense categories, cost and price estimates, pro-forma financial statements. Negotiating contracts. Licensing. Methods of valuation. Exit strategies. Discussions with successful entrepreneurs are integral to the course. Prerequisites: at least junior standing and ENSP II or permission of minor program director.

The program aims to prepare students from all undergraduate colleges at Lehigh with the skill sets, attitudes and understanding of the processes to realize their entrepreneurial goals in either an emerging or established company setting. The program is designed to be generally accessible to students from all disciplines with an emphasis upon innovation, the entrepreneurial process, and cross-functional integration. The pedagogy relies upon the concept that it is critical for entrepreneurs to be able to capitalize on and integrate different functional skill sets.

The program is designed for those interested in all types of entrepreneurship, and because of Lehigh’s strengths the program will particularly emphasize the commercialization of technology based businesses and services. Throughout the multi-disciplinary, team-based curriculum, students will be encouraged to work either on projects related to Lehigh University intellectual property, or ideas brought in by outside entrepreneurs, or on their own entrepreneurial projects.

INTEGRATED PRODUCT DEVELOPMENT

In 1994, Lehigh University’s pioneering Integrated Product Development {IPD} program was established in response to a corporate need for college graduates who are prepared to work in-group settings as multi-functional, self-directed and team-oriented professionals [Ref 8,9,10,11]. The IPD program fills that need by providing opportunity for students to address real-world problems, design solutions or products to fit the needs, and develop a marketing plan to commercialize the product or process. The IPD program supports a mix of flexible, interdisciplinary academic courses within Lehigh’s PC Rossin College of Engineering and Applied Science, the College of Business and Economics, and the College of Arts and Sciences. Benefits to students of participation in the IPD program are many:

- Active, collaborative methodology is superior for developing team-oriented cooperation
- Creativity processes develop high-order cognitive skills while addressing real problems
- Focusing on the product development process develops competence in a broad range of technical, financial and design arts skills
- Inquiry-based approach nurtures leadership and interpersonal skills
- Formal written and oral presentations develop communication and graphics skills

In the yearlong capstone projects course students work in multi-discipline teams for corporate partners throughout the design, engineering and marketing stages of product development. From the development of entirely new products (and even new companies) to the redesign of existing products to the improvement of manufacturing processes, students experience firsthand the entrepreneurial experience of successful product design and

commercialization. Lehigh's Integrated Product Development program seeks industry sponsorship of undergraduate and graduate projects that have the following characteristics:

- Require a multidisciplinary student team from engineering, business and design arts
- Have a specific deliverable, such as a working prototype, software or business plan
- Have a participating external (to the University) sponsor who can dedicate ~4 hrs per week
- Be tractable, capstone courses require ~1,000 hours of work collectively by the team over 2 semesters
- Be amenable to the methods and best practices in creativity, innovation and new product development

For the Year 2005, there are 199 students from 25 departments working in 31 teams with 20 faculty advisors and 26 sponsoring companies. The students are divided into cross disciplinary project teams in five categories: 1) general Integrated Product Development (open to all majors), 2) Integrated Business and Engineering for IBE honor students only (these students work with local start up companies), 3) Computer Science and Business (computer science and business majors only), 4) E-Teams (student entrepreneurs working on their own projects) 5) Bio Engineering (IPD students working on Bio Engineering projects).

Regardless of the category, each team follows a prescribed process shown in Figure 1 with each group giving different emphasis to each phase. For example the IPD programs, the students teams focus on Phase 2 and 3 while the faculty and company sponsor deals with Phase 1 and the company is responsible for Phase 4. For the student e-Teams, the teams take responsibility for all four phases and a fifth phase is added that deals with both a product and company exit strategy.

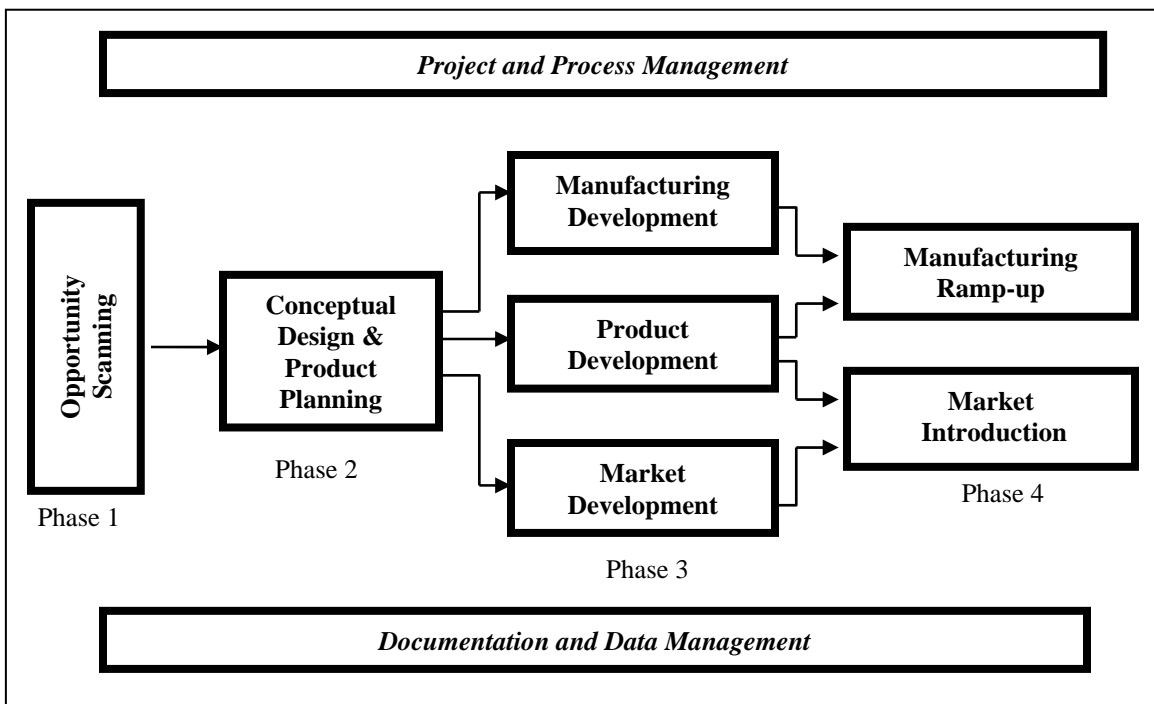


Figure 1. IPD Process

AN INTEGRATED, CROSS DISCIPLINARY APPROACH TO ENGINEERING EDUCATION

From an engineering point of view, the program educational objective is to graduate students in four years with an ABET accredited engineering degree with additional courses in both design arts and entrepreneurship and with hands on experience with cross disciplinary teams bring an real world industry product to the market in the capstone

IPD courses. A proposed four-year program in Mechanical Engineering and Mechanics which fulfills these objectives is shown below in Table 1.

Summer Session #2 Pre- freshman year (3)			
DES 3: Design Foundation I: Two Dimensional Design		3	
Freshman year fall (16)		Freshman year Spring (18)	
English 1	3	English 2	3
Math 21 or 31	4	Math 22 or 32	4
Chem 21, 22	5	Physics 11, 12	5
Engineering 1	3	Engineering 5 (projects)	3
Engineering 2	1	DES 4- 3D Design	3
Sophomore year fall (18)		Sophomore year spring (17)	
ME 10-Graphics for Engr Design	3	ME 104-Thermodynamics	3
ME 111-Professional ethics	1	Mech 12-Strength of Materials	3
Mech 2- Elementary Mechanics	3	Phys. 21,22	5
Mat 33-Materials and Processes	3	Math 205	3
Math 23	4	Entrepreneurship 1	3
Economic 1	4		
Junior year fall (17)		Junior Year spring (17)	
ME 21-Lab Methods 1	1	ME 121- Lab Methods 2	1
ME 231-Fluid Mechanics	3	DES 211- IPD I (Entre 3)	3
Mech 102-Dynamics	3	ME 240-Manufacturing	3
ECE 81-Electrical Engr	4	ME 242- Mech Systems	3
Math 208, 230, or 231 or ME 215	3	ME 252-Mech Elements	3
Entrepreneurship 2	3	ECE 162- EE lab	1
		Design Arts 164-Ergonomics	3
Senior Year fall (17)		Senior Year Spring (18)	
ME 207-Lab Methods 3	2	ME 208 or 210- Lab Methods 4	2
DES 212- IPD II (Entre 4)	3	Anthropology 11 Socio/Cul Anth	4
ME 321 Heat Transfer	3	MEM Tech Elective 3	3
MEM Tech Elective 1	3	MEM Tech Elective 4	3
MEM Tech Elective 2	3	MEM Tech Elective 5	3
Marketing 211/319-New Prod Mkt	3	DES 240- Prod Design	3

Table 1. BS in Mechanical Engineering and Mechanics with IPD, Design Arts & Entrepreneurship

The program described above totals 141 credits which is substantially over the required 131 but requires no overloads during the academic year but does require one summer course. Any semester with a Design Arts course can be further reduced by taking one or more Design Arts courses in the pre freshman and/or pre sophomore summers. Also note that in many cases the 200 or 300 level Marketing and Design Arts senior year course can be applied to a 30 credit Masters of Engineering program, reducing the Masters program by 6 credits. With the spring 2004 approval of the Design Arts majors and minors and the Spring 2005 approval of the entrepreneurship minor, this comprehensive program with depth in mechanical engineering and breadth in both design arts and entrepreneurship is now possible. This comprehensive four year program will need no further approval but will need to be advertised and promoted. This integrated engineering degree has companion degrees in the other undergraduate colleges as well. For example one can imagine a Management and Marketing degree with minors in engineering and design arts or a Design Arts degree specializing in product development with minors in engineering and entrepreneurship.

SHARED FACILITIES – THE WILBUR POWERHOUSE

A critical issue with any new program is space. With the start of several new programs this issue is amplified. Through the efforts of a dedicated faculty, supportive administration and generous alumni, Lehigh has been able to provide space for these new initiatives. In the fall of 2003 the university dedicated a 17,000 sq ft facility call the Wilbur Powerhouse to support the university's special programs including Design Arts, IPD, IBE, CSB and student entrepreneurs. The theme of the building is "Where design education and entrepreneurship meet." The Powerhouse includes an entire floor dedicated to computer graphics, space for a student shop and paint room, project spaces, class rooms, lounge space and a incubator space for student companies. This unique building is managed by full time staff who reports to a oversight committee of faculty from all four colleges. Student and faculty users of this shared space are encouraged to participate in procedure development and policy making decisions through their program directors, student clubs and bi-annual assessment.

ASSESSMENT

Throughout this development, assessment has been designed into the curricula, programs, courses and facilities. From the beginning, the overall vision, goals, program components and assessment metrics have been developed in coordination with ABET criterion. Assessment occurs each semester and includes peer evaluation, course assessment, program assessment and facility assessment including faculty, staff and graduate assistants. Several tools have been developed specifically for assessing the special features of these distinctive programs. In addition we invite students and faculty to participate in focus groups to give first hand feedback to help us continuously improve.

LESSONS LEARNED AND NEXT STEPS

In the development of any new initiative it takes dedication, patience and perseverance to see the project to conclusion. It also takes collaboration and flexibility. In the multi year process that it takes to realize these programs, the university administration has changed many times. So in addition to all of the other traits, you must also learn to sell your ideas, often over and over again. In that regard you must also be your own public relations department, advertising and promoting your accomplishments both internally and externally.

In this regard our next step in the near future is to advertise the design arts major and minor, entrepreneurship minor and comprehensive programs as described in exemplified in Table 1. One of the key measures of success will be the number and quality of students who decide to take these programs. Our plan is to continue to improve the individual components of these programs as well as to invent unique combinations that provide both the depth within a major and breath across disciplines within an integrated structure and philosophy and supported by an interdisciplinary faculty and facility.

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Anna Chupa

Anna Chupa is Associate Professor in the Department of Art and Architecture, College of Arts and Sciences at Lehigh and Director of the Design Arts Program. She has an M.F.A. degree from the University of Delaware, M.A.L.S. from Dartmouth College and a B.A. from Livingston College (Rutgers University). From 1996-2004, she taught multimedia and animation at Mississippi State University where she served as the graduate coordinator of the Electronic Visualization program. While at Mississippi State, she worked on multimedia projects for the Department of Defense and for the National Park Service. Current research areas include digital imaging for textiles, and experimental video and animation for live performance. Her digital photography, installations and animations have been exhibited in Darmstadt, Milan, San Malo, Montreal and throughout the United States.

Todd A. Watkins

Todd A. Watkins is Associate Professor in the College of Business and Economics and Director of the Institute for Regional Political Economy at Lehigh. He holds Ph.D. and M.P.P. degrees from Harvard and a B.S. from the University of Rochester. He previously worked in optical design and optical manufacturing engineering at Eastman Kodak. His research and teaching involves the economics of innovation, manufacturing and new product development. From 1999 to 2002, as the Faculty Fellow to the Provost, he was responsible for promoting innovative, inquiry-based curriculum campus wide. For seven consecutive years, teams advised by Dr. Watkins have won start-up grants in national competitions for collegiate technology entrepreneurship.