Program and Student Performance Assessment in Team-Based Project Courses with Focus on Technical Entrepreneurship and Product Development: Lehigh University's IPD Program

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Academic Abstract

In general, assessing the experiential learning process is difficult because objective measures are not readily available. The tools used to assess a student's performance should represent all meaningful aspects of that performance as well as provide equitable grading standards. This difficulty is perhaps exacerbated in team-based courses, where learning is, in large part, unstructured and the body of knowledge expected to be learned is variable. As a result, novel techniques need to be developed to assess the value of team-based learning. This paper describes Lehigh University's assessment model for courses focused on technical entrepreneurship and product development.

Executive Summary

Assessing the learning process is often difficult, especially in an area like entrepreneurship where objective measures are not readily available. This difficulty is perhaps exacerbated in team-based courses, where learning is, in large part, unstructured and the body of knowledge expected to be learned is variable. As a result, novel techniques need to be developed to assess the value of team-based learning. This paper describes the experiences and lessons learned in

assessing student performance in team-based, project courses focused on technical entrepreneurship.

The tools used to assess a student's performance should represent all meaningful aspects of that performance as well as provide equitable grading standards. In a curriculum that focuses on entrepreneurship through experiential team based learning, there are often no paper assignments or final exams that accurately measure the learning that has occurred. What are the "gradeable" moments? Which are appropriate assessment tools for each segment of the technical entrepreneurship/product development process? What about a student's understanding of the underlying process and their willingness and ability to immerse themselves in the entrepreneurial/product development "journey"? We believe the assessment tools presented here, applied and developed over the last ten years, address this need. The rubrics, surveys and evaluation forms in the appendices may be adapted to other courses as curriculum is developed.

The Accreditation Board for Engineering and Technology (ABET) and the Association to Advance Collegiate Schools of Business (AACSB) have both made assessment for the purpose of continuous improvement mandatory in their accreditation criteria. By developing and implementing innovative and appropriate assessment models, programs can insure their continued achievement of the specific accreditation standards against which their programs are measured; effectively guaranteeing the future of our entrepreneurship programs and the quality of the educational experience the students will take with them into the future.

Course/Program Vision and Objectives

Integrated Product Development (IPD) at Lehigh University is a comprehensive integrated program that focuses on technical entrepreneurship through experiential learning. We use the new product development process as a means to the end of preparing our students to lead

companies in innovation, creativity and the commercialization of intellectual property. Our mission is to develop a truly cross-disciplinary entrepreneurial environment and culture at Lehigh. The program's objectives are student and faculty focused, and include personal, interpersonal and professional development, curricula development, and facilities development and implementation. There are two main tenets of our program: 1) innovation, fueled by creativity, is a powerful engine for local, national and global economic development, and 2) the greatest number of opportunities for innovation occurs at the intersection of disciplines. Our approach is to engage the entire campus community and attempt to have positive impact on the region, the nation and the world with our efforts.

Course/Program Components

The IPD program design is both multi leveled and comprehensive, as shown in Figure 1. The program supports pre-college outreach through summer and academic year programs and courses and supports a high school curriculum development. The freshman project course has evolved to focus on students enrolled in Lehigh's Integrated Business and Engineering (IBE) program and the freshman engineering experience. In Figure 1, the boxes marked "sequences" represent the support for curricula in Lehigh's three undergraduate colleges. These sequences have included the new curricula in Design Arts, IBE, Entrepreneurship, Computer Science and Business, and Bioengineering, as well as support for individual established departments such as Management and Marketing, Accounting, Mechanical Engineering and Materials Science and Engineering. The Capstone courses are the culmination of student experiential learning where they work in cross-disciplinary teams with faculty and graduate student mentors, as well as with mentors from both established and local start up companies. Projects are generated from our interactions with established companies that have a Lehigh connection, local startup companies

funded by state agencies, local entrepreneurs and student entrepreneurs. Each year we offer two courses for a total of 5 or 6 credits that are co-listed under engineering, business, and design. For our 2004 project year (Jan 2004 – Dec 2004) 194 students, representing twenty majors worked in 33 cross disciplinary teams with 18 faculty advisors.

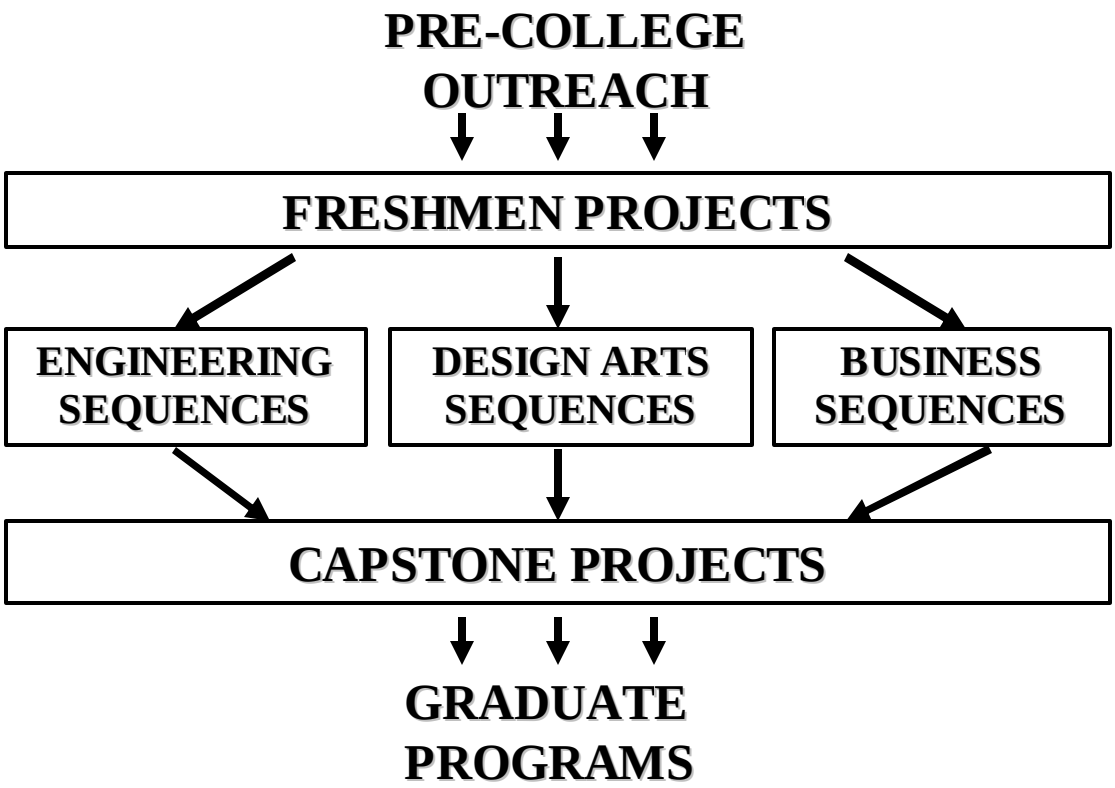

Figure 1. IPD Program Structure

In addition, graduate programs are under development and currently include independent programs in Engineering and Business, Arts and Sciences and our graduate College of Education. The Business college's *vSeries* seminars on new venture creation are part of the MBA program and the IPD graduate course in Engineering focuses on new product development with globally dispersed teams.

This comprehensive program has taken more than a decade to design, implement and develop a scalable and sustainable infrastructure. It required global thinking with local implementation.

Methods of Assessment

Assessment should not be an end-of-process activity, but rather an integral part of the planning process (Bell, 2000). Our course and program assessments included several approaches. On an annual and semester basis we have implemented the following:

1) internal, external, and self assessment of student performance including individual and team contribution to project and process;
2) faculty, industry and peer assessment of student/team project and process deliverables;
3) evaluation of courses, faculty, staff and facilities;
4) internal and external assessment of the overall program.

<u>Assessment of student performance within various courses</u>

Students in the various courses affiliated with IPD are asked to behave in ways that have not yet been asked of them in the traditional academic setting. They are asked to shift their focus away from a structured, traditional learning model, where grades are earned for learning the contents of a book or other collection of knowledge. In the IPD sequence students encounter a list of required deliverables to an external client (Table 1), where tasks are assigned and skill sets taught in a multi-disciplined, holistic way where the timing and importance of these deliverables are unique to each project. At the same time, students are immersed in the product development process working on industry or student sponsored entrepreneurial projects in multidisciplinary interdependent teams.

Project Background Section
Company description (size, core competencies)
Industry description (sector description, size, growth, major players)
Technology and product description
Management Section
Mission statement
Project time line and milestones
Information and data management
Relationship management
Project team description
Business Section
Identify the business opportunity
Describe the business strategy
Market research: analysis of competition, barriers to entry
Market plan: target markets, market segmentation and differentiation customer profile, pricing strategy and sales projections
Financial plan: base case financial modeling, profit models, cash flow models, sensitivity analysis
Distribution channels
Sales and promotion
Financial plan: base case financial modeling, profit models, cash flow models, sensitivity analysis
Distribution channels
Sales and promotion
Technology Section
Customer needs
Technical specifications
Competitive product benchmarking
Concept generation and concept selection
Product architecture and product platform
Industrial design
Final product description: assembly and system layout, CAD models, bill of materials, material selection issues, design for manufacturing and assembly issues
Cost analysis – fixed and variable costs, overhead and anticipated margins
Prototype fabrication – differences between product design and prototype, fabrication issues, lessons learned
Prototype testing – features to be tested, test set up, test results, lessons learned
Production plan and costs – production layout, economies of scale, build versus buy decisions, supplier network, anticipated capital investments
Conclusion and Recommendation Section
Restatement of value proposition
"Go-no go and why"
Lessons learned

Table 1. Topics for final report

We have found it necessary to assess student project-work, course-work and team-work in novel ways so that at the end of term grade accurately reflects each student's performance. We believe that an accurate assessment is that which creates a clear picture of what students have learned and are now capable of doing, as opposed to what they have accomplished or delivered to their client. In this way, within the context of the experiential environment that is IPD, failed projects often produce the greatest learning. Through research and a great deal of trial and error we have found that carefully designed rubrics are appropriate for assessing most aspects of this type of student performance.

As Bush and Timms (2000) state in their article on Rubric and Portfolio Based Assessment in the National Business Education Yearbook: "A well articulated and publicly visible rubric can become the meeting ground that facilitates a shared understanding of what the students should know and be able to do". So if rubrics answer the question, by what criteria should student performance be measured, we must first decide which work and what criteria are appropriate for grading. The IPD assessment model for student performance includes rubrics that evaluate: individual contributions to the product development effort; monthly tackboard or "crit" sessions; quarterly written reports; quarterly review of personal notebooks; written and oral reports at the end of each course; and quarterly peer evaluations. The student's performance assessment via these rubrics is roughly distributed as 60% team grade shared by all and 40% individual grade (See Appendix A - IPD Assessment Rubrics).

Functionality of IPD Assessment Model

IPD teams are advised by a host of faculty advisors from widely varied disciplines, who each bring a different set of priorities and biases to the project, and who had been the sole grade givers until this model was introduced two years ago. Because the IPD capstone course includes

students from the colleges of engineering, arts and sciences and business, and since the product development process includes unique engineering, design and business components, the course deliverables are widely varied. Among the Gantt charts, customer needs matrices, competitive benchmarking activities, functional diagrams, concept screening, design for manufacturing, financial modeling, system level design, detailed design, CAD modeling, prototype design and build, testing protocols and production ramp-up definitions, there are traditional straightforward, scoreable paper assignments. But what about a student's understanding of the underlying process and their willingness and ability to immerse themselves in the entrepreneurial product development journey? We believe this type of evaluation can be made by carefully assessing the project/course artifacts generated by the team during the course of the semester. These are publicly presented in three ways: a poster, a final written report and an oral presentation, usually accompanied by PowerPoint and/or other visual media . Faculty, students and industry sponsors attend and evaluate the oral and poster presentations via specific rubrics (Appendix A). These presentations are the embodiment of the "gradeable moments" that have occurred during the life of the project. The confirmation that the underlying process has been learned is unmistakable in these deliverables, and they are well suited for rubrics as assessment tools.

Assessment of course/program outcomes

In order to create an entrepreneurial environment for any and all majors from across Lehigh's four colleges, the vision, goals and objectives, program components and outcomes have also evolved to be multi leveled. While curricula and courses have explicit learning objectives that relate to accrediting standards of the Accreditation Board for Engineering and Technology (ABET, 2005) and the Association to Advance Collegiate Schools of Business (AACSB, 2005), the overall program assessment provides another integrating and comprehensive context for the

assessment of individual curricula, courses, students, faculty, staff and facilities. This approach allows us to assess the readiness of our students for real world leadership positions in entrepreneurial enterprises that, by necessity, are cross disciplinary.

Common among many courses such as the Integrated Business and Engineering Freshman workshop, Engineering Freshman Experiences, and the IPD capstone courses, is the use of self assessment by the students of their knowledge before, during and after the course. Based on the learning objectives, students rank their current level of knowledge of such topics as teaming skills and understanding of the product development process. Table 2 is an example self assessment, developed for the IBE Freshman Workshop. For a typical class size between 35 to 45 students, the assessment can start at the first day of class with an expected outcome for most students of 1.0. At the end of the semester the expected outcome would be between 4 and 5.

Evaluation of courses, faculty, staff, industry sponsors and facilities

At the end of each course, students have the opportunity to assess the course, the faculty, the staff, their industrial clients and the facilities (Appendix B). In addition, students are invited to participate in a focus group session held at the beginning of the following semester. This session is prepared by a professional assessment person and run by an objective facilitator. The session is to identify the strengths and to solicit suggestions for improvements in the previous semester's course. This process and content has been well received by both the faculty and the students.

Overall program assessment

Annually the faculty, staff and industry sponsors assess the progress of the program to achieve its vision and identify lessons learned in the process. To this end, we have developed additional rubrics (Appendix C), distributed evaluation surveys (Appendix B) and held focus groups.

As stated in the course objectives, currently I	Select 1 to 5 with 1 being the lowest and 5 being the highest ranking				
am more able to work in an interdisciplinary team of students from engineering to business	1	2	3	4	5
can more effectively communicate through oral and written and graphical presentations	1	2	3	4	5
have a clearer understanding of engineering and business practices in a competitive marketplace context	1	2	3	4	5
believe I could develop a simple business plan	1	2	3	4	5
am better able to identify and meet customer needs in business and engineering problem solving	1	2	3	4	5
gained a basic understanding of the role of major elements of businesses and their supply chains	1	2	3	4	5
can perform basic technical and financial feasibility studies	1	2	3	4	5
learned the basic skills needed to manage a team project including people and time resources	1	2	3	4	5
am better at defining and addressing open-ended, ill-defined problems	1	2	3	4	5
am more willing to ask questions of others to help me solve problems	1	2	3	4	5
have an introductory understanding of how to apply analytical, computer and physical modeling to engineering and business problem solving	1	2	3	4	5
better understand the role of market and engineering testing	1	2	3	4	5
will be a better engineer or business decision maker	1	2	3	4	5

Table 2. Self Assessment of current knowledge as related to the course objectives

Evaluation of Assessment (Challenges and Affirmations)

In terms of student performance assessment, an ongoing challenge for the IPD program has been faculty advisor buy-in to the new assessment model. Because the program admits upward of 200 students per project year, and creates between 20 and 30 project teams, there are necessarily faculty members that have been assigned team advisorships without having been adequately indoctrinated in the IPD process and assessment standards. It is important to note that the IPD course leaders who develop and teach the product development curriculum and therefore create and implement the assessment tools, are often different from the faculty advisors

who are asked to oversee the teamwork and give grades on the deliverables. Although it is widely agreed upon that the creation of a rubric should be connected to the curriculum from the initial course content planning stage, that is not always possible. In the case of IPD, it is unreasonable to expect 20 or 30 IPD faculty advisors to participate in creating assessment instruments for each project, so it is imperative that they participate in learning how best to use them. The findings of Marzano (2002) state clearly "training and guidance on the scoring of assessments increases the precision with which those assessments are scored".

Another major issue when dealing with equitably assessing multiple teams is consistency among the faculty advisors. Setting expectations and quality goals requires the development and implementation of standards. We are actively developing these and, once again, it is not easily done. Implementing these can be equally difficult especially with faculty advisors who do not share a common set of expectations or who are harder or easier graders. Creating a set of rubrics to be used by all advisors to assess all students on all teams on widely different projects is to attempt to create equity in grading standards where there is no standard set of outcomes. As a way to develop this commonality, we require that all first-time faculty partner, apprentice-like, with an experienced faculty member as co-advisors. While resource intensive, this has gone a long way to develop advocates for the cross disciplinary team approach to experiential education. In addition, we provide support to all faculty advisors in the use of each assessment tool as it is introduced.

Likewise, program assessment can be painful and is not easily done. The process takes time and valuable scarce resources. However, it is an extremely valuable key first step in continuously improving the courses, curriculum and programs. Developing the evaluation mechanisms as part of the overall planning of any activity, forces you to define what you mean

and is a visual tool to document plans, build consensus and make course corrections during implementation. In addition, we recommend that our assessment scenario for program evaluation be used as a tool to gather information about the impact of what you are already doing. It is not a mandate to change what you know is right. For example, certain aspects of the IPD program consistently get poor rankings on the course evaluation. These include the text book, the homework and the design notebook. During the course, students consistently fail to appreciate the need for and relevance of these activities. However, we know from feedback from industrial sponsors that in many cases the students do not know what is good for them. Most students lack the frame of reference necessary to understand what it takes to succeed in a professional environment. It is our job to teach them and set expectations for both behavior and performance. As well, the feedback is additional incentive to try to improve these and all other aspects of the course, curriculum and program.

So What ?

There are two important (and related) reasons that entrepreneurship educators should care about innovative forms of assessment. First and foremost is accreditation. The major accrediting bodies such ABET and AACSB have made assessment for the purpose of continuous improvement mandatory in their accreditation criteria.

By developing and implementing innovative and appropriate assessment models, programs can insure their continued achievement of the specific accreditation standards against which their programs are measured. Specifically, the ABET initiative Engineering Criteria 2000 (EC2000) focused on what is learned rather than what is taught. At its core was the call for a continuous improvement process informed by the specific missions and goals of individual programs. EC2000 encouraged new assessment processes and subsequent program improvement. The

spirit of the EC2000 initiative has been upheld and incorporated into ABET's current evaluation criteria (2005).

Secondly, entrepreneurship educators should care about innovative assessment models for the purpose of self-preservation. Entrepreneurship is rapidly expanding across the pedagogical landscape, yet the question "Can entrepreneurship be taught?" is still being asked. Due to the fact that so many skill sets and learning objectives that pertain to the entrepreneurship curriculum are practically impossible to assess using standard measurement instruments, new methods must be developed along with the curriculum. AACSB under its "Assurance of Learning" standard requires that the students meet the expectations embodied in the learning goals and that the faculty monitor student performance to see that learning goals are respected. More specifically, the AACSB "Performance to Standards" requires that individual faculty should continuously work to improve their skills at providing feedback in ways that enable and motivate learning. (2005). AACSB suggests that course-embedded exercises be used as a main function of student performance assessment. However, our experience with more than 200 technology entrepreneurship-related student project teams over the last decade leads us to believe that course-embedded exercises are rarely going to indicate the true learning that is (or isn't) taking place in many of the varied aspects of entrepreneurship education. Unless an entrepreneurship program can measure and evaluate the "gradeable moments" that occur apart from tests, reports and other paper assignments, it makes itself vulnerable to pedagogical obsolescence.

Conclusion and Future Plans

The rubrics and other assessment tools presented here address the need for objective measures of student performance that are not otherwise readily available. Equally important is the faculty use of these tools as instruments for collecting the information needed to evaluate

student performance in team-based project courses. We are convinced that the key to appropriate assessment and grading equity is the buy-in and education of the faculty advisors. One effective way to get their buy-in is the admission that these are not by any means perfect, that they are not set in stone, and that they must be continually improved and updated by interested and committed faculty.

Likewise, we are firm believers in the value of program assessment. It is best done with both internal and committed external reviewers and with everyone's input. It is worth the expense and is here to stay--embrace it for its value. As any experienced educator knows, the true measure of impact occurs many years after the course has been completed and the student has graduated. This begs for longitudinal studies. In addition to exit interviews, we need to measure impact one, three and five years after graduation. This too requires a commitment of resources often beyond those of any individual program or even major. At Lehigh University steps are under way to engage the alumni association and the university development office in these longitudinal studies. In the near future we hope to report on our efforts to capture the long term effects of our team-based, project-focused experiential education to see if we do indeed offer an effective competitively differentiating experiential education.

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LISA GETZLER-LINN

Lisa Getzler-Linn is the Associate Director of Lehigh University's Integrated Product Development (IPD) program, the multi-phased program in which business, engineering and arts & sciences students work together to produce and market new products, as well as Academic Projects Manager for IPD and the Integrated Business & Engineering honors program, managing all aspects of product development and process improvement projects. Currently she is leading the initiative to establish both an Entrepreneurs Network and a student run Entrepreneurship Club at Lehigh. Along with mentoring students through the product development process her interests and research focus on intellectual property issues for student entrepreneurs, ethics in entrepreneurship, and assessment of student performance in multi-disciplined, team-based courses.

JOHN B. OCHS

Professor John B. Ochs has been teaching engineering design at Lehigh University since 1979. Since 1995 he has worked with an interdisciplinary team of faculty and students from business and arts to establish undergraduate and graduate curricula focusing on experiential learning through industry projects. The award winning IPD program is now in its 6^{th} year with over 150 industry-sponsored projects and over 750 student participants. In addition to the IPD program Professor Ochs is the founder and director of the Mechanical Engineering and Mechanics Computer Aided Design Lab and co-director of the Dravo Design and Prototype Shop. Professor Ochs teaches and does research in Computer Graphics for Engineering Design, Geometric Dimensions and Tolerances, Manufacturing, and many types of computer graphics modeling and simulations. Professor Ochs has been involved in several startups, two of which have been moderately successful. He is a member of the Acoustical Society of America, the Society of Manufacturing Engineers, the American Society of Mechanical Engineers and Phi Kappa Phi.

TODD A. WATKINS

Todd A. Watkins is an Associate Professor of Economics in the College of Business and Economics at Lehigh University. He holds Ph.D. and M.P.P. degrees from Harvard University, and a B.S. from the University of Rochester. Prior to graduate studies, he worked in Optical Design and Optical Manufacturing Engineering for the Eastman Kodak. Author of more than 40 related publications, his research focuses on technology policy, defense industries, dual-use manufacturing and the economics of innovation. Teaching areas also encompass the role of technology in trade & economic growth; managerial economics; technical entrepreneurship and new product development. He co-founded Lehigh's Community Research and Policy Service (Lehigh COPRS), was one of the founders of the IPD Program, national winner of the ASME Curriculum Innovation Award, and chaired the committee that created Lehigh's undergraduate Entrepreneurship program. Watkins also won the 2002 Outstanding Instructor award from the National Technology University, for his teaching via distance learning. In 2004 he was named a member of The National Academies' Committee on Innovation Models for Aerospace Technologies, to advise NASA on improving their innovation processes.

Relative Progress	**Project Scope**	**Value Statement**	**Communication**	
Findings displayed on tackboard indicate that 5 or 6 students have worked diligently for a month-probably each putting in 5 - 10 hours per week. 10 9.5 9	Mission Statement and/or Project Description are clear, concise & demonstrate asolid understanding of project scope. 10 9.5 9	Tackboard reflects that the team has an understandingof both the business & technical challenges of this project and that they are building a foundation which will allow them to move forward in a business context. 10 9.5 9	Team is able to clearly articulate the scope of the project. They are able to answer questions apropppriate for this timeframe and have taken ownership of the project. 10 9.5 9	**A**
Findings displayed on tackboard indicate that 3 or 4 of the students have worked conscientiously for a month-probably each putting in 3-6 hours per week. 8.9 8.5 8	Mission Statement and/or Project Description are not entirely clear & demonstrate a less than solid understanding of project scope. 8.9 8.5 8	Tackboard reflects that the team has a partial understanding of the business & technical challenges of this project and that they will soon begin to build a foundation which will allow them to move forward in a business context. 8.9 8.5 8	Team is somewhat able to articulate the scope of the project. They are able to answer some questions and have begun to take ownership of the project. 8.9 8.5 8	**B**
While it is clear that the level of effort does not meet the standard outlined above, it is also clear that some work has been done by at least some of the group. 7.9 7.5 7	Mission Statement and/or Project Description are fairly generic. It is unclear as to whether the team has a solid understanding of the project scope. 7.9 7.5 7	Tackboard reflects that the team has some sense of the project's business & technical challenges. It is unclear how they will begin to address these issues in a business context. 7.9 7.5 7	Able to answer very basic questions, it seems that with more time the team will develop a full understanding of the project and will begin to take ownership. 7.9 7.5 7	**C**
Findings displayed on Tackboard indicate that the team has not come close to meeting the level of effort outlined above. 6.9 6.5 6	Mission Statement and/or Project Description do not demonstrate an understanding of the scope of the project. 6.9 6.5 6	There is little or no reference to the technical or business challenges that might occur within this project. 6.9 6.5 6	Team is unable to articulate the scope of the project and is unable to answer questions beyond the information given at the project fair. No sense of ownership is in evidence. 6.9 6.5 6	**D**
Relative Progress Score: _____ +	Project Scope Score: _____ X 2 = _____ +	Value Statement Score: _____ +	Communication Score: _____ =	Sub Total _____ divide by 5 _____ **total**
	to plug this score into final grade breakdown use this formula: _____ x .25 = _____ total			

Notes:

Tackboard 1 Summary	**Market Research**	**Product / Solution Architecture**	**Ergonomics & Aesthetics**	**Target Specifications**	**Status of Best Concept**	
Complete team info: students, faculty, company, mentor, logo are all clearly identified; Mission statement, target customers & customer needs stated clearly & concisely in the "language of the customer." 10 9.5 9	Clear results reported on projected impact on production quantity & efficiency (PIP) or market size & production quantity (PDP); target specs including costs or price have been thoroughly researched; clear competitive benchmarking of key specs is evidenced. 10 9.5 9	The architecture of the solution has been clearly established through the use of schematics. An approximate geometric layout is evidenced that includes descriptions of major chunks & key interactions among chunks. 10 9.5 9	Critical aesthetics & user requirements have clearly been considered in the development of the concept/solution. 10 9.5 9	Team has established a refined set of specifications which spell out in precise, measurable detail what the product has to do in order to be commercially acceptable. Customer needs, differentiating factors, technical & financial feasibility have clearly been considered in the process. 10 9.5 9	The team's best concept is clearly represented by way of process/function diagram, sketches or models, mock ups or actual products. Team is able to articulate their best concept and all of its attributes to date. 10 9.5 9	**A**
Team info: students, faculty, company, mentor, logo - many but not all are identified; Mission statement is included; target customers & customer needs are identified & stated adequately. 8.9 8.5 8	Some results reported on projected impact on production quantity & efficiency (PIP) or market size & production quantity (PDP); target specs including costs or price are referenced but not determined; competitive benchmarking of key specs is addressed adequately. 8.9 8.5 8	The architecture of the solution seems to have been established. Schematics & an approximate geometric layout are included but do not include descriptions of major chunks & key interactions among chunks. 8.9 8.5 8	Aesthetics & user requirements may have been considered in the development of the concept/solution. 8.9 8.5 8	Target specifications have been refined and it's evident that some trade-off decisions were made. Target values have been quantified to some extent. It seems that customer needs have been considered in the process & that technical & financial feasibility have been accounted for. 8.9 8.5 8	The team's best concept is adequately represented by way of process/function diagram, sketches or models, mock ups or actual products. Team is able to articulate many aspects of their best concept. 8.9 8.5 8	**B**
Incomplete team info: students, faculty, company, mentor, logo - some are missing; Mission statement is either unclear or too general; Target customers & customer needs are not referenced in enough detail. 7.9 7.5 7	Projected impact on production quantity & efficiency (PIP) or market size & production quantity (PDP) & target specs including costs or price are either unclear or mentioned too briefly. Competitive benchmarking of key specs is addressed inadequately 7.9 7.5 7	The architecture of the solution is unclear. There is some reference to schematics and geometric layout but not enough to determine their quality. 7.9 7.5 7	There is little evidence that aesthetics & user requirementswere considered in the development of the concept/solution. 7.9 7.5 7	Target specifications have been stated in a general way. It is possible that some trade-off decisions were made, though not clear. Target values have been referenced but not quantified. Customer needs may have been considered in the process. 7.9 7.5 7	Best concept is only partially represented by the inclusion of some process/function diagram, sketches or models, mock ups or actual products, but could have used more. Team is able to articulate only a few aspects of this concept. 7.9 7.5 7	**C**
It is difficult to tell who the team is and what they are doing. There is little or no detail given covering the names of the students, faculty, company, mentor or logo. There is no reference to target customer needs. 6.9 6.5 6	Projected impact on production quantity & efficiency (PIP) or market size & production quantity (PDP) & target specs including costs or price are either missing or extremely vague; competitive benchmarking of key specs is not addressed. 6.9 6.5 6	There does not appear to be any product/solution architecture work. There is no evidence of schematics or geometric layout 6.9 6.5 6	It is clear that aesthetics & user requirements were not considered in the development of the concept/solution. 6.9 6.5 6	Target specifications have not been stated or are too unclear to understand. If decisions were made based on trade-offs, target values, or customer needs there is little or no evidence of them. 6.9 6.5 6	The team's best concept is not appropriately represented through process/function diagram, sketches or models, mock ups or actual products. Team is unable to articulate any aspects of their best concept. 6.9 6.5 6	**D**
Tackbd 1 Summary Score	Market Research Score	Product Architecture Score	Erg & Aesth Score	Target Specifications Score	Status of Best Concept Score	
_____ +	_____ X 2 = _____ +	_____ +	_____ +	_____ X 2 = _____ +	_____ X 2 = _____ =	_____ 9
	to plug this score into final grade breakdown use this formula: _____ x .25 = _____ Total					_____ **total**

Individual Notebook

Notebook Attributes	Record of Intellectual Property	Format	Essential Elements	
Project Journal: A mixture of written text and engineering/marketing/business analysis that is a clear chronological record. Consideration is given to BOTH project development and team leadership/team member behavior. Reflections on IPD course objectives and what has been learned so far by the writer 9 9.5 10	All plans, both carried out and abandoned are documented. All analytical work, design ideas, technical specifications, experiments, financial estimates, sources and significant thinking are noted and dated in this record. 9 9.5 10	The Notebook itself is the correct one. The requisite care was taken to reserve pages for a Table of Contents, each page was numbered, signed and dated. Entries were not crowded and ink was used when any patenting questions were involved and all data was entered contemporaneously. 9 9.5 10	Experimental/business/market data, interview data, analyses & interpretation thereof; Analytical work, calculations& conclusions; Graphs, charts with labels, titles and interpretations; Sketches, CAD drawings, models & photographs titled and interpreted; References to information sources; Test instrumentation output (if applicable) with titles and interpretation. 9 9.5 10	Level A
Project Diary: A mixture of written text and engineering/marketing/business analysis that is a clear chronological record. Consideration is given to BOTH project development and team leadership/team member behavior. 8 8.5 8.9	Many of the carried out plans are documented - few of the abandoned plans are mentioned. A good deal of analytical work, design and technical specifications and sources are recorded in the notebook. 8 8.5 8.9	The notebook is the correct one and a Table of Contents was added or squeezed in. Most pages are numbered signed and dated. Little preference was given to ink vs. pencil regardless of the information being entered. Data seemed to have been entered on a regular and contemporaneous basis. 8 8.5 8.9	Experimental/business/market data, interview data, with some analyses & interpretation thereof; Some calculations& conclusions; Graphs, chartssometimes with labels, titles and interpretations; Labeled Sketchesand/or CAD drawings; References to information sources; Some reference to testing. 8 8.5 8.9	Level B
Project ScrapBook: A collection of notes, sketches, etc. with isolated written thoughts that suggest some sense of direction or progress is evolving. 7 7.5 7.9	Some plans for the project, along with some design ideas and technical references are in evidence. There is some reference to sources and ideas for the project. 7 7.5 7.9	The notebook may be the correct one but no Table of Contents exists and for the most part the pages are either not numbered, not dated or not signed. Data has been entered haphazardly and at uneven intervals. 7 7.5 7.9	Some data & calculations; Graphs, charts w/ labels; Sketches and/or CAD drawings; References to information sources 7 7.5 7.9	Level C
Project NotePad: A collection of lists, classnotes, facts & figures, etc. that are meaningful mainly to the writer of the Notebook. A limited and scattered message to the outside reader. 6 6.5 6.9	Very little content is recorded. Most of the text is referncing class notes or advisor's suggestions. 6 6.5 6.9	The notebook is not the required type. The entries do not follow the reccommended format nor is the information entered in any discernible fashion, if at all. 6 6.5 6.9	Very little in the way of data, calculations, graphs and charts. No references to information sources 6 6.5 6.9	Level D

raw score	Notebook Attributes Score:		Record of Intellectual Property Score:		Format Score		Essential Elements Score:	
formula	_____ x 2 = _____	plus	_____ x 3 = _____	plus	_____ x 1 = _____	plus	_____ x 1 = _____	_____ subtotal divide by 7
								_____ total **

NOTE: Faculty Advisor may opt to give the grade "INCOMPLETE". To do so, place a large letter "I" at the top of the page and instruct your team as to requirements for re-submitting work.

To plug this score into final grade breakdown use this formula: __total **x .1** = _____
(Notebook Total Possible Score-5)

Poster

	Technical Content		Financial Content		Graphics / Models		Organization		Presentation / Aesthetics	
	Technical content is so in depth and well explained, it represents that the work done and knowledge gained by team members was at an exemplary level. 9 9.5 10		Financial modeling is well formed and well presented on poster. All important aspects of financial issues related to project are represented clearly and concisely. 9 9.5 10		Graphics are exemplary. CAD models are both sophisticated and understandable. Graphics used add to the overall impact of the poster. 9 9.5 10		Information is organized in a manner that is easily understood. Topics flow smoothly and groupings are appropriate. 9 9.5 10		The poster is exceptionally attractive in terms of layout, design and neatness. 9 9.5 10	Level A
	Technical content is clearly represented and shows that a substantial amount of knowledge was gained by the team. 8 8.5 8.9		Financial models are represented to some degree. Some aspects of financial issues related to project are represented. 8 8.5 8.9		Graphics are used effectively. CAD or other models are suitably accurate and help to further explain project outcomes. 8 8.5 8.9		Information is loosely organized and is somewhat easy to follow. Topics and groupings are somewhat related to each other and most are easy to understand. 8 8.5 8.9		The poster is attractive in terms of layout, design and neatness 8 8.5 8.9	Level B
	Technical content is insufficiently represented to show the level of knowledge that might have been gained by the team. 7 7.5 7.9		Financial modeling is referred to but not clearly represented on poster. It is not clear whether the issue was not completely dealt with or whether it was not considered a necessary component on poster. 7 7.5 7.9		Graphics used relate to the project but are not easily understood. They neither help nor hinder the explanation of project outcomes 7 7.5 7.9		Information is slightly disorganized. Topics could be relevant , but flow is disjointed and makes it difficult to tell. 7 7.5 7.9		The poster is acceptably attractive though it may be lacking in either layout, design or neatness. 7 7.5 7.9	Level C
	There is not enough technical content to indicate that any knowledge was gained or used to further the project. 6 6.5 6.9		Financial modeling or any reference to it does not appear on poster 6 6.5 6.9		Graphics are not used at all or are very poorly executed. 6 6.5 6.9		Information is disorganized. Topics do not relate to each other. There is no flow between topics. 6 6.5 6.9		The poster is poorly designed, poorly laid out or distractingly messy. 6 6.5 6.9	Level D
raw score	Technical Content Score:		Financial Content Score:		Graphics / Models: Score		Organization: Score		Presentation / Aesthetics Score:	
formula	_____ x 2 = _____	plus	_____ x 2 = _____	plus	_____ x 1 = _____	plus	_____ x 1 = _____	plus	_____ x 1 = _____	equals _____ subtotal divide by 7 equals _____ total

NOTE: Faculty Advisor may opt to give the grade "INCOMPLETE". To do so, place a large letter "I" at the top of the page and instruct your team as to requirements for re-submitting work.

To plug this score into final grade breakdown use this formula: _total_ **x .1** = _____
(Poster Total Possible Score- 10)

Team Oral Report

	Professionalism		Overall Content		Technical Content		Continuity		Preparedness	
	Presentation was given in such a manner that the students could have been mistaken for employees of the company. 9 9.5 10		Every topic covered was well researched and relevant. Audiovisual components contributed a great deal to the presentation. 9 9.5 10		Introduction of company, project objectives, market research, design concepts, technical & financial feasibility & plans for future work were all fully discussed within the time constraints. 9 9.5 10		As each team member took their turn there was a smooth transition. All segments were equally well presented. All team members were fluent in the topics presented. 9 9.5 10		Every aspect of the presentation was well rehearsed and every member of the team was prepared to speak and answer questions about their topic area. 9 9.5 10	Level A
	Presentation was well done and appropriate. It had a flavor of professionalism that was slightly beyond the students academic status. 8 8.5 8.9		The topics covered were presented with a fair amount of detail and level of relevance. Audiovisual components supported but did not enhance presentation. 8 8.5 8.9		Introduction of company, project objectives, market research, design concepts, technical & financial feasibility & plans for future work were addressed with some detail mostly within the time constraints. 8 8.5 8.9		There was some level of comfort when transitioning between team members. Some segments werebetter prepared and represented than others. Some team members were more familiar with their content area. 8 8.5 8.9		Most of the presentation was prepared and most team members were able to speak about their topic area. Most questions were answered. 8 8.5 8.9	Level B
	Presentation was given in a manner consistent with student behavior. No level of professionalism was attained. 7 7.5 7.9		The topics covered were limited in scope and depth. Audiovisual components were problematic and detracted somewhat from the presentation. 7 7.5 7.9		Introduction of company, project objectives, market research, design concepts, technical & financial feasibility & plans for future work were not all addressed & time was not used wisely. 7 7.5 7.9		There were a few awkward moments between segments and some team members seemed unsure of what to do next. Only one or two team members seemed comfortable with the content of the presentation. 7 7.5 7.9		Some of the presentation seemed prepared. One or two team members dominated; some members were less prepared than the rest. Some ability to answer questions was apparent. 7 7.5 7.9	Level C
	Presentation was not only unprofessional but below college level standards. 6 6.5 6.9		The topics covered were not clearly related to the project outcome nor were enough topics covered. Audiovisual components were either scarce or 6 6.5 6.9		There didn't seem to be a full understanding of the need for above topics to be included in presentation. Only a cursory view of the project was presented. 6 6.5 6.9		The presentation was disjointed. There was little or no continuity. The team was not able to articulate an adequate amount of information. 6 6.5 6.9		The team was not at all prepared to speak or answer questions on the topics relevant to the project. No rehearsal was apparent. 6 6.5 6.9	Level D
raw score	Professionalism Score:		Overall Content Score:		Technical Content Score:		Continuity Score:		Preparedness Score:	
formula	_____ x 1 = _____	plus	_____ x 2 = _____	plus	_____ x 2 = _____	plus	_____ x 1 = _____	plus	_____ x 1 = _____	equals _____ subtotal divide by 7
										equals _____ total **

To plug this score into final grade breakdown
use this formula: _total_ **x .15** = _____
(Team Oral Presentation Total Possible Score- 15)

NOTE: Faculty Advisor may opt to give the grade "INCOMPLETE". To do so, place a large letter "I" at the top of the page and instruct your team as to requirements for re-submitting work

Written Report

Introduction		Market Research		Design Concept Description		Feasibility		Format	
Project background, purpose & objectives; company description; customer description & needs; literature, patent & competition search are all fully researched & discussed. Team description is well written & complete. 9 9.5 10		Competitive benchmarking, target specifications & constraints, marketing channels & strategies, target costs & price are all fully researched, understood & reported. Section is extremely well written & complete. 9 9.5 10		Functional diagram or description of overall concept, all aspects of preferred design/solution including assessment ofindividual industrial design issues are all fully reported & well represented. Concept descriptions & sketches where applicable are exemplary. 9 9.5 10		Concept & market selection methods & scoring, detailed description of final design for implementation, discussion of costs, pricing & margin, Base case financial model are all covered in detail & discussed completely. 9 9.5 10		Formatting is precisely prepared as required course leaders. Abstract & Intro clearly outline the findings in the paper. Appendices, tables & figures where included, are exemplary. 9 9.5 10	Level A
Project background, purpose & objectives; company description; customer description & needs; literature, patent & competition search are covered, some have been researched & discussed Team description is fairly well written. 8 8.5 8.9		Competitive benchmarking, target specifications & constraints, marketing channels & strategies, target costs & price are represented in report, some more fully than others. Section is well written for the most part. 8 8.5 8.9		Functional diagram or description of overall concept, all aspects of preferred design/solution including assessment of individual industrial design issues are reported & represented fairly completely. Concept descriptions & sketches where applicable are appropriate. 8 8.5 8.9		Concept & market selection methods & scoring, detailed description of final design for implementation, discussion of costs, pricing & margin, Base case financial model are all covered & discussed, some better than others. 8 8.5 8.9		Majority of report is correctly formatted as required by course leaders. Abstract & Intro reference much of the report. Appendices, tables & figures where included, are appropriate. 8 8.5 8.9	Level B
Project background, purpose & objectives; company description; customer description & needs; literature, patent & competition search are partially covered, a few are missing. Team description is acceptable. 7 7.5 7.9		Competitive benchmarking, target specifications & constraints, marketing channels & strategies, target costs & price are covered to some degree, although some details are missing. Writing in this section is acceptable. 7 7.5 7.9		Functional diagram or description of overall concept, all aspects of preferred design/solution including assessment of individual industrial design issues are mostly all represented or reported to some degree. Concept descriptions & sketches where applicable are acceptable. 7 7.5 7.9		Concept & market selection methods & scoring, detailed description of final design for implementation, discussion of costs, pricing & margin, Base case financial model are coverd for the most part and discussed to some degree. 7 7.5 7.9		Report is partially correct in format. Some attention is paid to course leader requirements.Abstract & Intro reference some of the report. Appendices, tables & figures where included, are acceptable. 7 7.5 7.9	Level C
Project background, purpose & objectives; company description; customer description & needs; literature, patent & competition search are either too breifly represented or not covered at all. The team descritption is poorly written 6 6.5 6.9		Competitive benchmarking, target specifications & constraints, marketing channels & strategies, target costs & price are not all covered and few topics are covered well. Writing in this section is unacceptable. 6 6.5 6.9		Functional diagram or description of overall concept, all aspects of preferred design/solution including assessment of individual industrial design issues are only partially represented or are missing. Concept descriptions & sketches where applicable are either unacceptable or missing. 6 6.5 6.9		Concept & market selection methods & scoring, detailed description of final design for implementation, discussion of costs, pricing & margin, Base case financial model are either not covered oror the content is unacceptable. 6 6.5 6.9		Report follows no discernable format. Abstract & Intro were either poorly constructed or non-existant. Appendices, tables & figures were either not included or inappropriate. 6 6.5 6.9	Level D

raw score	Introduction Score		Market Research Score		Design Concept Description Score		Feasibility Score		Format Score:	
formula	_____	plus	_____	plus	_____	plus	_____	plus	_____	____ subtotal divide by 5
										____ total **

NOTE: Faculty Advisor may opt to give the grade "INCOMPLETE". To do so, place a large letter "I" at the top of the page and instruct your team as to requirements for re-submitting work.

To plug this score into final grade breakdown
use this formula: total **x .25** = _____
(**written report total possible score - 25)

Individual Contribution

Technical Contribution		Contribution / Resourcefulness		Leadership & Team Work		Professionalism & Interaction with Sponsor	
Technical knowledge gained and contributed set the course of the project. Amount and quality of work was paramount to the successful outcome of the project. 9 9.5 10		Took on more than their share of the workload & identified & pursued most of the resources needed to find the best solution for almost every aspect of the project. 9 9.5 10		Inspired the vision of the team, nurtured a team harmony, and took on a role of leader when appropriate. Always a team player. Guided the progress of the project and delegated responsibilities; was paramount in project's success. 9 9.5 10		Level of professionalism and maturity was exemplary. Fostered a positive professional relationship with others outside the team who were involved in the project, which added greatly to the success of the project. 9 9.5 10	Level A
Technical contribution was key in maintaining the integrity of the project. Amount and quality of work was key to the successful outcome of the project. 8 8.5 8.9		Carried out agreed upon portion of the work well and on time, occasionally picking up extra responsibilities Individual exhibited initiative and ingenuity in his or her work. 8 8.5 8.9		Willingly took on a leadership role as needed and did so efficiently and effectively. A team player. Interaction with team mates was positive and contributed significantly toward the project's success. 8 8.5 8.9		Level of professionalism and maturity was beyond that of an average college student. Interaction with others outside the team was more than satisfactory for the individual to effectively handle his/her responsibilities. 8 8.5 8.9	Level B
Technical contribution was somewhat limited and neither added nor detracted from the project outcome. Quantity or quality of work did not contribute to a relevant and focused solution. Project outcome was not affected. 7 7.5 7.9		Completed agreed upon share of workload, but quality and quantity of work was just the minimum. Individual did the work assigned but showed little initiative. 7 7.5 7.9		Accepted leadership in minor aspects of the project but was not efficient or effective. Sometimes a team player. Interaction with the team did not contribute significantly toward the team's success. 7 7.5 7.9		Level of professionalism and maturity did not exceed that of an average college student. Interaction with others outside the team neither inhibited nor contributed to successful discharge of responsibilities. 7 7.5 7.9	Level C
Technical contribution was practically non-existant. Quality and quantity of work was generally unsatisfactory and often detracted from the team's focus oand the project outcome. 6 6.5 6.9		Did not complete share of the workload. Individual was often complacent and took no initiative - let others do the majority of the required work. 6 6.5 6.9		Did not assume a role of leadership in any aspect of the project. Rarely a team player Contribution to the team was sometimes counterproductive. 6 6.5 6.9		Level of professionalism and maturity was unsatisfactory. Little (if any) ability to communicate effectively with others outside the team detracted from ability to carry out necessary responsibilities. 6 6.5 6.9	Level D
raw score	Technical Contribution Score:		Contribution / Resourcefulness Score:		Leadership & Team Work Score:		Professionalism & Interaction with Sponsor Score:	
formula	_____ x 2 = _____	plus	_____ x 3 = _____	plus	_____ x 1 = _____	plus	_____ x 1 = _____	_____ subtotal divide by 7
								_____ total **

NOTE: Faculty Advisor may opt to give the grade "INCOMPLETE". To do so, place a large letter "I" at the top of the page and instruct your team as to requirements for re-submitting work.

To plug this score into final grade breakdown use this formula: _total_ **x .2** = _____
(Individual Contribution Total Possible Score-2

Appendix B

Student Assessment of course, faculty, staff industry sponsor and facilities

I learned a great deal in this course	1 2 3 4 5
The overall quality of the course was good	1 2 3 4 5
Overall, the instructors teaching was effective	1 2 3 4 5
The amount of work was appropriate for the credit received	1 2 3 4 5
I put in per week on average this many hours of work outside of class	1 2 3 4 5
The project had a successful outcome	1 2 3 4 5
I would recommend this course to other students	1 2 3 4 5
the weekly "crits" were valuable and pertinent	1 2 3 4 5
the homework was useful in learning the material	1 2 3 4 5
the weekly "crits" were valuable and pertinent	1 2 3 4 5
the homework was useful in learning the material	1 2 3 4 5
most helpful:	1 2 3 4 5
least helpful:	1 2 3 4 5
the instructors presented the material clearly	1 2 3 4 5
the faculty were available and interested in our learning	1 2 3 4 5
the instructors answered our questions clearly and concisely	1 2 3 4 5
grading procedures were fair and effective	1 2 3 4 5
I found the on-line course website useful	1 2 3 4 5
the personal/team notebooks were helpful in organizing the project	1 2 3 4 5
our team meetings were effective	1 2 3 4 5
overall, our team was effective	1 2 3 4 5
our work in the reverse engineering labs was productive and yielded a positive outcome	1 2 3 4 5
Faculty Advisor was available and interested in our project.	1 2 3 4 5
Faculty Advisor functioned as a valued member of the team.	1 2 3 4 5
Faculty Advisor was helpful when students were confused.	1 2 3 4 5
Faculty advisor treated the students with respect.	1 2 3 4 5
Our weekly meetings with the Faculty Advisor were effective.	1 2 3 4 5
Our weekly meetings without the Faculty Advisor were effective.	1 2 3 4 5
Interaction between the students and advisor was positive.	1 2 3 4 5
Sponsor-mentor was interested and involved in our work.	1 2 3 4 5
Sponsor-mentor had expectations that were reasonable.	1 2 3 4 5
Sponsor-mentor returned our phone calls & emails in a timely manner.	1 2 3 4 5
Our site visits were helpful and informative.	1 2 3 4 5
Our team was well balanced and multidisciplinary.	1 2 3 4 5
Our work in the MEM CAD lab was productive and yielded a positive outcome	1 2 3 4 5
Our work in the Arts & Architecture MAC lab was productive and yielded a positive outcome.	1 2 3 4 5
Our work in the Arts & Architecture Prototype lab was productive and yielded a positive outcome.	1 2 3 4 5
The student lab was available and user friendly for our purposes.	1 2 3 4 5
The IPD administrator played a valued role in our team's management.	1 2 3 4 5
The IPD outreach manager played a valued role in our team's progress	1 2 3 4 5

Appendix B

											Spring '03
		Integrated Product Development {IPD}									
		Peer Evaluation Form									
Team Member :											
Project Title :											
1	***A***	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***Y***	***Z***
Team Members	**Task Definition**	**Technical Contributions**	**Reports and Presentations**	**Prototype Fabrication**	**Finding Resources**	**Interaction w/Sponsor**	**Leadership**	**Teamwork**	**Ethical Conduct**	**Area of Greatest Contribution**	**Distribution of $10k bonus**
Most effective member(s)											
Least effective member(s)											
Please note below anything else indicative of your performance or that of any other team members.											

Table 3. Peer evaluation form

Appendix B

Instructions for completing the peer evaluation form

Use these instructions and the Excel spread sheet (peer_evaluation_spreadsheet.xls):

Instructions:

Rate each team member (including yourself) with respect to the areas listed in each of the column headings.

Column one: Write the names of all team members (including yourself) in alphabetical order.

Columns A - I: Rate each member from 1 to 10 (1 being the lowest rating and 10 the highest rating) in each category. Enter "N/A" (not applicable) if a category does not apply to an individual.

Column Y: Enter the area (one of columns A through I) in which each member made his/her greatest contribution.

Column Z: Enter the share of a $10,000 bonus which you would distribute to each team member (including yourself) based on their overall contributions to the project.

In the last two lines of the table, for each column, put the name(s) of the member(s) who was most/least effective in that aspect of the project.

NOTES:

1. Individuals rarely excel in all aspects of the project work. A low score in some areas will therefore not necessarily result in a poor grade for you or your teammates.
2. In order to ensure that you have responded thoughtfully, consider filling in a copy of the form, waiting a day, and then reconsidering your entries before turning in your form.
3. This should be your own evaluation. It is not appropriate to discuss your evaluation with other team members.

These replies will be read only by your advisor and will be kept confidential

Appendix B
Self Assessment of current knowledge as related to the course objectives

As stated in the course objectives, currently I	Select 1 to 5 with 1 being the lowest and 5 being the highest ranking				
am more able to work in an interdisciplinary team of students from engineering to business	1	2	3	4	5
can more effectively communicate through oral and written and graphical presentations	1	2	3	4	5
have a clearer understanding of engineering and business practices in a competitive marketplace context	1	2	3	4	5
believe I could develop a simple business plan	1	2	3	4	5
am better able to identify and meet customer needs in business and engineering problem solving	1	2	3	4	5
gained a basic understanding of the role of major elements of businesses and their supply chains	1	2	3	4	5
can perform basic technical and financial feasibility studies	1	2	3	4	5
learned the basic skills needed to manage a team project including people and time resources	1	2	3	4	5
am better at defining and addressing open-ended, ill-defined problems	1	2	3	4	5
am more willing to ask questions of others to help me solve problems	1	2	3	4	5
have an introductory understanding of how to apply analytical, computer and physical modeling to engineering and business problem solving	1	2	3	4	5
better understand the role of market and engineering testing	1	2	3	4	5
will be a better engineer or business decision maker	1	2	3	4	5

Appendix B

Sponsor Questionnaire

We are very interesting in obtaining feedback from the companies that sponsored IPD projects and are especially interested in your written comments at the end of this survey. Your individual responses will be kept confidential useless you agree in writing that we can use them for public relations purposes.

Thank you for your time and for providing us with this invaluable feedback information.

1. How satisfied are you with the extent to which students took advantage of your knowledge and expertise?

   ☐ Not at all satisfied
   ☐ Somewhat
   ☐ Moderately
   ☐ Very satisfied

2. Outside of scheduled events (e.g., poster session, final presentation), how often were you in contact with members of the team?

   _____ hr/week

3. Please put a check next to all the methods that students used to contact you.

Site visits	☐
Telephone call	☐
E-mail	☐
Fax	☐
Letter	☐
Course Info Web Site	☐
Other	☐

   Please specify any other methods.

4. How satisfied were you with the amount of interaction with the student team members?

   ☐ Not at all satisfied
   ☐ Somewhat
   ☐ Moderately
   ☐ Very satisfied

Comments on interaction with student teams.

5. How much work DID YOU EXPECT to put into the project?

- ☐ Very little work
- ☐ Some work
- ☐ Sufficient amount to get job done
- ☐ Above and beyond the requirements

6. How much work DID YOU ACTUALLY put into the project?

- ☐ Very little work
- ☐ Some work
- ☐ Sufficient amount to get job done
- ☐ Above and beyond the requirements

7. How much work do you feel that STUDENTS put into the project?

- ☐ Very little work
- ☐ Some work
- ☐ Sufficient amount to get job done
- ☐ Above and beyond the requirements

8. How satisfied are you with the faculty advisor and his/her role in keeping the team on tract?

- ☐ Not at all satisfied
- ☐ Somewhat
- ☐ Moderately
- ☐ Very satisfied

9. Were you able to attend the poster session? ☐ Yes ☐ No

If yes, how satisfied were you with your team's poster?

- ☐ Not at all satisfied
- ☐ Somewhat
- ☐ Moderately
- ☐ Very satisfied

10. Were you able to attend the team presentation? ☐ Yes ☐ No

    If yes, how satisfied were you with the team's presentation?

    ☐ Not at all satisfied
    ☐ Somewhat
    ☐ Moderately
    ☐ Very satisfied

    If you were not very satisfied with the team presentation, please explain.

11. How satisfied are you with the final report for this semester?

    ☐ Not at all satisfied
    ☐ Somewhat
    ☐ Moderately
    ☐ Very satisfied

If you were not very satisfied, please explain

12. At this time, how would you characterize the progress of your team in the development process?

    ☐ Very behind schedule
    ☐ Slightly behind
    ☐ On schedule
    ☐ Ahead of schedule

13. At this time, how would you characterize the progress of your team in understanding the business context of your project?

    ☐ Very behind schedule
    ☐ Slightly behind
    ☐ On schedule
    ☐ Ahead of schedule

To what factors do you attribute the progress or lack of progress?

14. How satisfied are you at this time with the overall state of the project?

- ☐ Not at all satisfied
- ☐ Somewhat
- ☐ A great deal
- ☐ Completely satisfied

15. Overall, how satisfied are you with your experiences with the IPD Program?

- ☐ Not at all satisfied
- ☐ Somewhat
- ☐ Moderately
- ☐ Very satisfied

16. What factors made this a positive experience for you?

17. What factors made this a negative experience for you?

18. What suggestions do you have to improve the process?

Your Name:

Your Title:

Your Company Name:

Thank you for your feedback!

Appendix C

	Overall Program Rubric				
Educational Objectives	**Constituents**	**Processes**	**Outcomes Assessment**	**Results**	**System**
Not well defined	Informal contact	Few, if any processes defined and documented	Limited to ad hoc efforts	Anecdotal	None evident
Broadly defined and documented: clearly tied to mission; evidence of constituent input	Somewhat involved in defining objectives and desired outcomes, and assessment	Some major processes defined and documented; clearly tied to mission and program objectives	Some outcomes defined and improved in systematic manner; problems recognized and corrected	Satisfactory outcomes; some evidence of positive trends in areas deployed	Early stages; partial deployment within the program and college
Comprehensive; defined, documented' and measurable; clearly tied to mission and constituent needs	Clearly involved in defining objectives and desired outcomes, and assessment; evidence of some sustained strategic partnerships	Processes for all major elements of criteria defined, documented, and controlled; clearly tied to mission, program objectives, and constituent needs	All major outcomes defined; systematic evaluation and process improvement in place; problems anticipated and prevented	Good outcomes; positive trends in several major areas; some evidence that results caused by systematic approach	In place; deployed throughout the program and college; driven by mission and objectives
Comprehensive; defined, documented and measurable; clearly tied to mission; responsive to constituent needs; systematically reviewed and updated	High degree of involvement in defining objectives and desired outcomes; evidence of many sustained strategic partnerships in all constituent groups	Processes for all elements of criteria are quantitatively understood and controlled; clearly tied to mission, program objectives, and constituent needs	All outcomes defined; systematic evaluation and process improvement in place; many support areas involved; sources of problems understood and eliminated	Excellent outcomes; positive trends in most areas; evidence that results caused by systematic approach	Integrated; deployed throughout the program, college and support areas; driven by mission and objectives
Comprehensive; defined documented, measurable and flexible; clearly tied to mission; readily adaptable to meet constituent needs; systematically reviewed and updated	High degree of involvement in defining objectives and desired outcomes, assessment; and improvement cycles; sustained evidence of strategic partnership with all key constituents	Processes for all elements of criteria are quantitatively understood and controlled; clearly tied to mission; program objectives, and constituent needs; seen as benchmarks by other institutions	All outcomes defined; systematic evaluation and process improvement in place; all support areas involved; common sources of problems understood and eliminated	World-class outcomes; sustained results; results clearly caused by systematic approach	Sound, highly integrated system; deployed throughout the program, college, and institution; driven by mission and objectives