

INTEGRATION OF ENTREPRENEURSHIP-TEAM CONCEPT INTO DESIGN CLASSES

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Abstract

A proposal submitted to the National Collegiate Innovators and Inventors Alliance (NCIIA) and the Lemelson Foundation in 1997 was funded to modify the Philosophy of Design Course (ME234) in the mechanical engineering department at Cal Poly, San Luis Obispo. The grant was for the integration of E-Teams in the above-mentioned course.

An E-Team, as defined by NCIIA and the Lemelson Foundation, is a group of students who perform a design activity in a classroom setting. The product they design is supposed to be commercially viable (hopefully patentable), or socially useful. It stands for Entrepreneurship Team or Excellence Team. The concept of Entrepreneurship Teams was integrated into the Philosophy of Design course at Cal Poly.

The course is modified to include E-Teams of 4 students each. The E-teams are formed on the first day of class, randomly, and continue as a team throughout the Quarter. Each E-Team is asked to follow the design process that is covered in class, from initial problem finding to the evaluation of the final product. The process also involves patent searches to ensure that no patents are infringed, and that the idea may be patentable.

In most cases, E-teams construct a prototype, and demonstrate the product to the class in an oral report during the final week of instruction. Each team also writes and submits a report to the instructor.

Introduction

A proposal submitted to the National Collegiate Inventors and Innovators Alliance (NCIIA) and the Lemelson Foundation in 1997 was funded to modify the Philosophy of Design Course (ME234) in the Mechanical Engineering Department at Cal Poly, San Luis Obispo. The grant was for the integration of E-Teams in the above-mentioned course.

An E-Team, as defined by NCIIA and the Lemelson Foundation, is a group of students who perform a design activity in a classroom setting. The product they design is supposed to be commercially viable (hopefully patentable), or socially useful. The concept of Entrepreneurship Teams was integrated into the Philosophy of Design course at Cal Poly in Winter 1998.

Before the integration of E-Teams into the course, which has been taught in the department since 1984, the course was about creative design of products and systems, and involved creative processes, design process, and design elements such as patents, design communication, human factors, liability, safety, and economics, among other things. The course also involved the design of a product on paper, where the students picked from a list, and finished the design during the last three weeks of the quarter. The content of the course has remained the same after integration, except that now students are involved in E-Teams instead of the final project.

Methodology

With the aid of the Grant, the course is modified to include E-Teams of up to 4 student each. The students are all juniors or seniors, and may have had traditional machine design courses. Students are assigned to E-teams on the first day of class, randomly, and are asked to form themselves into a fictitious company, and operate as such. This includes, but is not limited to, company name and logo, set of by-laws about the relationship between the group members, the mission of the company, the position of each member within the company, methods of conflict resolution, duties, meeting times, etc. Students are advised to consult the information available on the Small Business Administration and the Internal Revenue Service web-sites. Although the funding from the Lemelson Foundation provided budgets for the student groups during the first 2 years, team members are generally responsible for the cost of prototyping their project. At times, the instructor may provide components or other resources to groups based on availability and need.

Subsequently, each E-Team is asked to follow the design process that is covered in the lecture, from initial problem identification to the evaluation of the final product, and including problem definition, idea generation, idea selection, final design, and implementation. Each team is asked to find a set of ideas for new products with social significance or possible commercial value. In Winter 2002, all groups were asked to focus on the design of a new product for the disabled. The ideas are discussed between the instructor and the teams, and a final project concept is picked. Later, the Teams are asked to completely define the project with all relevant specifications necessary, such as the users, the desired function, the range of final cost, appearance, and the environment in which the product may be used. Subsequently, students are asked to find solutions for the product, select the best solution through a variety of techniques, design the final product, build it, and test the product. E-Teams are asked to follow the ideas discussed in class and to incorporate the design elements, including human factors, safety, aesthetics, product liability, economics, and manufacturing, into their design. The process also involves patent searches to ensure that no patents are infringed, and that the idea may be patentable. The Patent and Trademark Office (PTO) web-site is extensively used by all teams to perform patent searches. When necessary, complete patent texts are ordered from the PTO.

Whenever possible, E-teams construct a prototype of their product or design, and demonstrate the product to the class in an oral presentation during the final week of instruction. Many teams choose to prepare video clips intended for either demonstrating the functions of the product, or for advertising its value. Each team also writes and submits a report to the instructor. The reports are used both for grading purposes as well as to document the design process in case

any of the products are patented. The reports include the students' design notebooks. Initially, the grant from NCIIA covered the cost of prototyping and supplies, at the range of \$100 to \$150 per team. However, since Winter Quarter 2001, the team members have paid for their prototypes. Even at the \$100-150 per team, which translates to \$25-35 per team-member, it appears that the cost is not prohibitive even if no external grant is available.

The following is a list of some of the projects that have been undertaken in the past three years:

1. Washing Machine Water Reclamation Unit
2. Equine Forelimb Knee Joint Angle Measuring Device
3. A Toddler Quad Unit (Stroller, Car Seat, High Chair, Walker Unit)
4. La Pompa, A Better Bike Pump
5. Personal Shrimp-Peeler/De-veining Tool
6. Design of a Manual Hand-Held Sewing Machine
7. Bicycle Lighting System
8. Personal Beverage Cooling Unit
9. C-Cure Security System
10. Super Saturator Water Gun
11. Earthquake Gas Shut-off Valve
12. Student Desk Expander
13. Pneumatic Sealant Gun
14. Hand-Held Dishwasher
15. Adaptive Oil-Change Device
16. Rotating Bookshelf for the Disabled
17. G7 Grabbing Device for the Disabled
18. Pottery Centering Device
19. Jig for Accurate Angular Hole Spacing and drilling
20. Quick Chill Device for Personalized Use
21. Car Undercarriage Cleaner
22. Tight-Type Pipe Cutter
23. The Quick Bike Lock
24. Low Profile Car Jack
25. Multi Purpose Grocery Bag Holder
26. Bike Umbrella
27. Low Emission Hair Dryer
28. Photovoltaic Vehicle Refrigeration System
29. Automatic Squeegee System
30. Constant Volume Liquid Dispenser
31. Automatic Coffee Maker
32. Enhanced Snow Chains
33. Household Garage Storage Device
34. Y2K Dolly
35. Mechanic's Creeper with Brakes
36. Power Lift for a Disabled Person

Result

The integration of E-Teams into the course has been very successful and enjoyable. The students do enjoy designing and prototyping their own ideas, knowing that it could someday be patented or used commercially. The majority of the prototypes work satisfactorily. The prototypes that do not work satisfactorily are the projects that are too involved, or the students are not experienced enough in manufacturing.

The class and project evaluations indicate that the students enjoy the exercise as well. Since the students have a limited budget, they have to balance the cost of their design with their budget, a realistic constraint. With the support from NCIIA and Lemelson Foundation two of the E-Teams have opted to continue the development of their product. This indicates how some groups enjoyed their design/business adventure.

Discussion

Although a grant supporting the student projects was the initial impetus to integrate E-Teams into a design course, we have continued with the concept even without a grant. The E-Team project has added to the value of the course, and has created a supportive environment for design projects. In the past two years, we have run the course and the E-Team projects without any external support. Thus, although other engineering programs may not necessarily have a grant to implement the idea, it appears that they should be able to do the same if they request students to underwrite the cost of prototype development.

NCIIA may be reached at <http://hampshire.edu/nciia> or at nciia@hampshire.edu.