

Project Driven Curriculum in the Mechanical Engineering Technology Program

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Abstract

The authors of this paper have incorporated a project driven approach into teaching engineering technology courses in the Mechanical Engineering Technology program at Penn State Hazleton. During the last five years, two projects were introduced and incorporated into the MET curriculum. The first project was to design and build a full-scale two seat experimental aircraft. The second project was a solar power car. This paper describes the administration and funding of these projects as well as the links between the project and the MET curriculum.

1. Introduction

Project based learning is an active learning method [1] which can make students self-motivated and active learners through the process, result, and analysis of the problem. Students can be naturally exposed to the teamwork environment and fully exercise their classroom knowledge into the real field application [2].

The authors of this paper have introduced two projects to first and second year engineering technology students. The projects were linked to the curriculum in Mechanical Engineering Technology at Penn State Hazleton. The design and development of an experimental airplane and a solar powered car have proven to be very challenging and highly motivating for the freshmen and sophomore students. To design and build the experimental airplane, students used the specifications developed by the instructors. They analyzed the feasibility of a full scale experimental airplane and designed the airplane based on their analysis. In the case of a solar powered car, students were involved in designing a chassis, suspension, power transmission and steering system from a conceptual design to the implementation of hardware. As an example, they decided the specifications of each component. In the case of the motor, students estimated how much horse power was required to operate the solar powered car, and how many solar panels were needed to charge the battery in order to achieve a real-time continuous operation.

The projects continued through the next academic year with a different group of students. Those students reviewed the previous design and worked to improve or modify it according to their analysis. Students used their knowledge from the classroom such as statics, dynamics, strength of materials, machine design, and so on. By applying the continuous design improvement process semester by semester, the instructors accumulated a history of the students' designs.

2. Project Administration and Funding

Very often in the engineering technology curriculum students are taking individual courses without the ability to cross reference the knowledge from one course to the other. The students are viewing these

individual courses as disjointed pieces of a puzzle. Most students do not see the “bigger picture” of the body of knowledge until they gain some industrial experience and get the opportunity to apply the knowledge that they had learned in their academic courses. The “project driven curriculum” allowed the students to see this “bigger picture” rather than the individual pieces of the puzzle [3]. As part of the Penn State Hazleton Mechanical Engineering Technology program, projects were introduced during the fall semester of the freshman year. These projects were being introduced in the Engineering Design and Graphics course. The project topics were selected to provide a comprehensive approach to engineering design and required knowledge of statics, dynamics, strength of materials, machine design, tool design, manufacturing processes, etc. The last two projects which were introduced were designing and building a solar powered car and designing and building an experimental aircraft. These projects were very successful in capturing the students’ interest as well as increasing the students’ motivation. In addition, the scope of the projects allowed them to be linked to all courses in the Mechanical Engineering Technology curriculum. Fig. 1 shows how the projects link to the individual courses in the Mechanical Engineering Technology program. In the Engineering Design and Graphics course (where the project was introduced) the objectives and specifications of the designs were developed. Then students worked on developing a list of tasks which needed to be completed during the designing process as well as during the process of building a prototype. The engineering faculty who were working with the students helped them to link the individual tasks to all the technical courses in the Mechanical Engineering Technology curriculum [4] (Fig. 1).

Project funding was secured through fund raising initiatives with local industry. ALCOA Foundation provided a majority of the funds needed to complete the projects. However, a number of other companies provided either financial or in-kind contributions by donating materials or labor. The building of the prototypes was done in co-operation with the local vocational-technical schools. The local vocational-technical schools were better equipped in terms of the tools needed to build the prototypes. The administration of funds and purchasing of materials was handled by the engineering faculty who are teaching in the Penn State Hazleton Mechanical Engineering Technology program.

The abbreviation and name of courses [4] related to the projects are below:

EDSGN 100: Introduction to Engineering Design
 EGT 114: Spatial Analysis and Computer Aided Drafting
 EGT 201: Advanced Computer Aided Drafting
 MCHT 111: Statics
 MCHT 213: Strength and Properties of Materials
 MCHT214: Strength and Properties of Materials Laboratory
 MET 206: Dynamics and Machine Elements
 MET 210W: Product Design
 IET 101: Manufacturing Materials, Processes and Laboratory
 IET215: Production Design

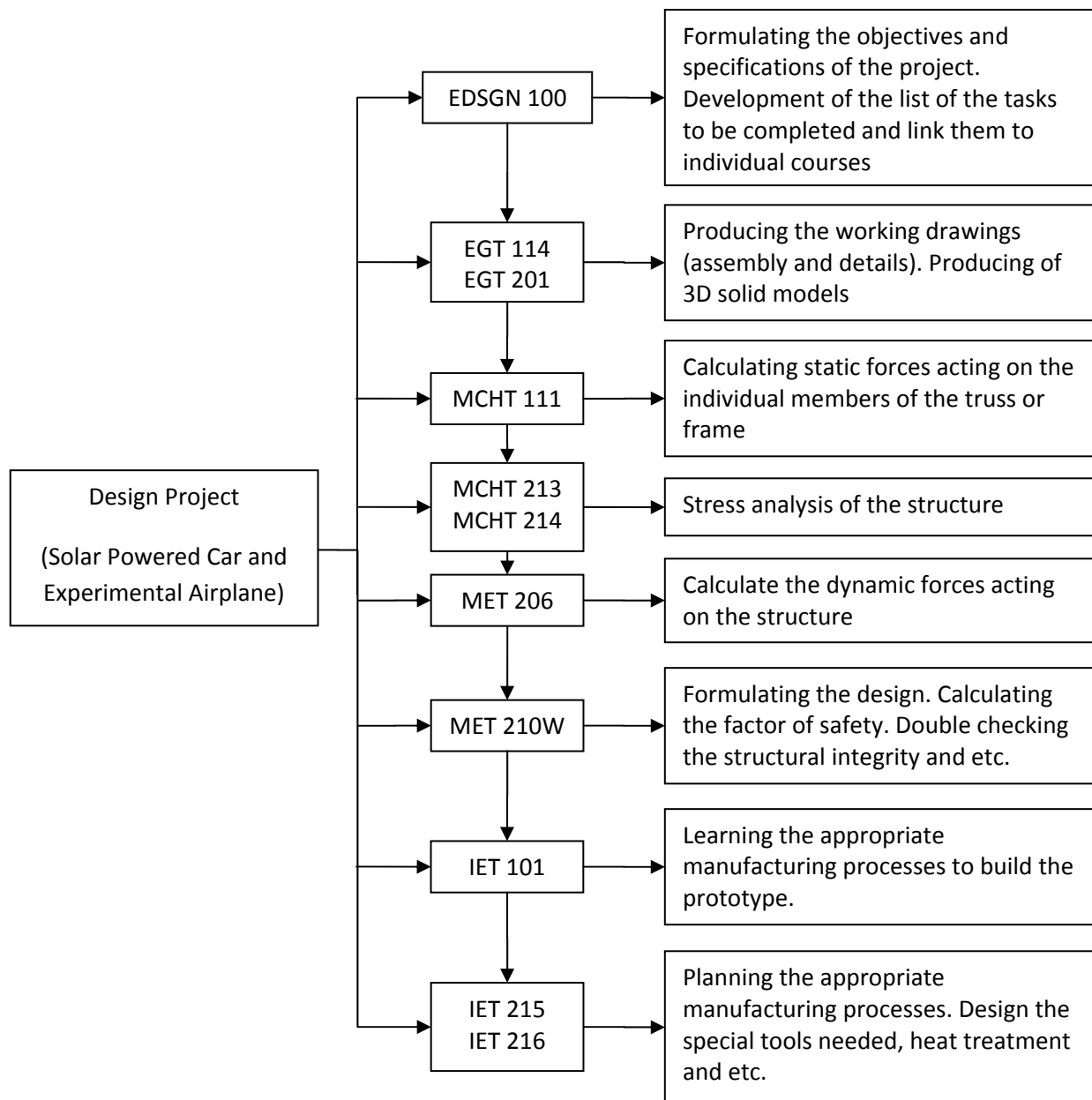


Fig. 1 Project related activities linked to the MET curriculum

3. Conclusion

This project based approach was found to be a very effective method for teaching engineering technology courses in the Mechanical Engineering Technology program at Penn State Hazleton. The authors of this presentation have noticed an increase in the students' motivation and performance. The project based approach also provides opportunities to expose students to a teamwork type of environment as well as addresses the need for lifelong learning.

References

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- [4] Undergraduate Degree Programs Bulletin of Pennsylvania State University, p.611-613.