

Effective Practices for Project Formation and Faculty Involvement in Capstone Design Courses

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ABSTRACT This workshop will focus on two critical and inter-related issues in capstone design projects - project formation and faculty involvement. Project formation is a notoriously difficult process in any environment, whether it be academia or industry. Teams must be formed, project concepts identified, a project selected, specifications and goals must be clearly identified, and implementation plans developed. Each of the preceding elements is critical to achieving success and requires a good level of understanding by both the students and faculty involved. Students often have little experience in this process and are challenged by its ambiguity and fluidity. Furthermore, faculty are not typically prepared by their academic training to understand or supervise capstone projects, and likewise find it challenging. This presents many barriers to effective and consistent project advising. When multiple faculty members advise projects there need to be consistent expectations and assessment methods. The inclusion of industrial sponsors and advisors adds another level of complexity, as their expectations are often different from those of the institution. This interactive workshop will focus on helping educators involved in capstone projects develop effective approaches for dealing with these issues. In particular, workshop will address the following topics: 1. Team formation • Models for forming student teams • Development and assessment of teaming skills • Selecting faculty advisors and defining their role • The roles of faculty and industrial advisors 2. Project selection models & scope assessment • Project selection models • Identifying industrial projects • Developing guidelines for students • Ensuring that projects are appropriate and addressing adequate technical content (i.e. inclusion of standards and realistic constraints and ABET Criterion 4) 3. Working with industrial sponsors • Developing guidelines for sponsors • Obtaining donations • Effective engagement of industry sponsors • Handling intellectual property issues and non-disclosure agreements • The role of industry sponsors in projects 4. Problem definition and development of specifications • Identification of projects needs • Writing problem statements • Development of verifiable and realistic project specifications • Development of realistic project plans 5. Faculty advisor development • Defining common learning objectives • Ensuring technical competence and uniformity of expectations • Development of assessment rubrics • Evaluation of projects by faculty committees • Rewarding faculty involvement • Continuous process improvement Participants in the workshop should expect to participate in an active-learning environment and bring their experiences and challenges to the workshop. Participants will learn about processes applied at other institutions, including those of at the workshop facilitators. Most importantly, participants will develop exercises and activities that they can apply in their own environment. The workshop will be planned for four hours, including a break. During this time it will not be possible to discuss all of the processes in detail; those that are more straightforward (e.g., project timeline, intellectual property agreement forms, etc.) will simply be presented, or their availability in the course materials will be pointed out. Other topics will be included as activities for

participants to take part in. A tentative schedule of activities for the workshop follows:

Time, min.	Description of activity	15	Introduction – presentation on the need for processes and overview	of projects timeline at Behrend	20	ACTIVITY – development of learning objectives	30	Team formation and development – presentation and discussion on models for forming student teams;
	ACTIVITY – team process		guidelines; team member assessment forms		25	Project identification – presentation and discussion on different models; guidelines for students	15	ACTIVITY – assessing project scope and appropriateness
	25	Industrial sponsors – presentation and discussion	15	BREAK	20	Faculty advisor development – presentation and discussion	30	Problem definition – overview of processes and instructions;
						ACTIVITY – assessment of specifications; project plans	30	Project evaluation – discussion of rubrics; ACTIVITY – development of rubrics for grading presentations; sharing of rubrics; presentation of Behrend rubrics
						15	Continuous improvement in capstone design – presentation and discussion	

About the Facilitators Bill Lasher and Ralph Ford are experienced educators who teach the capstone design courses in their respective programs. They have facilitated active learning and have been using active learning in their courses for a number of years. They have published numerous articles on pedagogical innovations in engineering and engineering design, and both have been nominated for The Behrend College Council of Fellows Excellence in Teaching Award. They have been instrumental in program and curriculum development and led their respective programs through initial accreditation in 1996 and re-accreditation under EC 2000 in 2002. The School of Engineering at Penn State Behrend has strong design-oriented undergraduate programs. All of the academic programs have year-long capstone projects and all faculty members in the School are actively engaged in senior projects – through both advising and serving on project committees. There is also a great variety in the number of projects – each project team works on a different problem – and there are nearly 100 different capstone design projects in the School each year. Over 1/3 of projects are sponsored by industry. The School hosts the annual Richard J. Fasnmyer Engineering Design Conference, in which all project teams present the results of their capstone project to the industrial and regional community. Bill Lasher is Program Chair of Mechanical Engineering. In addition to the capstone course, he has been the lead faculty for the introductory first-year design course at Behrend. He is an ASME fellow and has been active regionally and nationally on educational issues in mechanical engineering. Ralph Ford is Director of the School of Engineering and a faculty member in Electrical, Computer and Software Engineering. He is co-author of Design for Electrical and Computer Engineers, published by McGraw-Hill, a textbook devoted to capstone design for electrical engineers. He is also an ABET program evaluator.