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Integrating Professional Development Modules in the Engineering Curriculum

Introduction

A lack of professional development opportunities has been reported as a significant reason for choosing to drop out of the engineering major at the undergraduate level[1,2]. To address this issue, we focused on creating and piloting "full" and "mini" professional development modules as part of a multi-university National Science Foundation funded CCLI Phase II effort on "Professional Development Gateways in Social Learning Settings." The "full" modules were developed specifically for engineering and other STEM students to be folded or integrated directly into existing gateway and introductory courses where professional development is a pervasive underpinning to the course objectives. These modules were designed to be covered in a 50 minute classroom period with time for discussion. Contextualizing professional development outcomes by integrating them into existing gateway and professional issues courses provided significant improvements in student awareness (meta-cognition) of the professional world[3]. For the cases where no significant improvement was found, observations suggest that in order for the professional development intervention to be effective, the course format must be sufficient to adequately develop the instructional intervention strategies. Thus, to aid in this issue, "Mini" modules were developed to provide an additional means of integrating professional development issues into the curriculum. In this case, we anticipated the modules being used in capstone design courses where professional development issues are imminent in the student's career but course objectives broaden well beyond professional development. The "Mini" modules are brief overviews or subsections of the full module topics, and consist of four or five slides for easy integration. This paper focuses on the development and summary of these "Mini" modules.

Professional Development "Mini" Modules

"Mini" modules have been developed around three major topics: Educational Context; Professional Development; and, Engineering Ethics. The Educational Context "Mini" modules explore the development of engineering education through its history, the relationship between the missions of the university and individual engineering departments, and the overall philosophy of higher education. These modules are aimed for students early in their engineering programs. The Professional Development set of "Mini" modules is aimed at helping students interface with the professional workforce, and are aimed at the development of communication skills and goals in the context of finding a job and setting career goals. These modules are ideally suited for capstone design type courses. The last set of modules on Engineering Ethics provides case studies and can be integrated into a variety of courses. Brief descriptions of the "Mini" are provided below. The modules can be accessed for use at
http://www.ee.washington.edu/research/dms/ee/teacher.html?id=href-professionalDevelopement

- *Educational Context*

    · *History of Engineering (and Engineering Education):* A brief overview of how engineering curricula came to be as they are today. Covers how the balance of engineering science versus practice and design has changed over the years.

- *The Influence of the Department/University Mission:* A brief overview of the connections between the local university and local engineering department missions, along with the role of ABET in developing program outcomes.

- *Philosophy of Higher Education:* An introduction to the overarching philosophy of education and how it fits in with a quality engineering education. The role of ABET in formulating curriculum requirements is discussed.

- *Professional Development*

  - *Informational Interviews:* A brief introduction to the use of informational interviews to learn more about a company or a particular position within the company. The module places information interviews in the context of interpersonal skills. It provides a brief overview of what to do in conducting an informational interview.

  - *Job Interviewing:* An overview of how to prepare for job interviews. The module places job interviews in the context of interpersonal skills. Different types of questions that can be expected in an interview are covered, including behavioral questions. Provides detailed information of what to do before, during, and after the interview.

  - *Networking:* An overture to how networking can help students take advantage of the connections that they have. The module places networking in the context of interpersonal skills. A simple exercise is provided for students to identify their own network connections.

  - *Rapport and Active Listening:* An introduction of how one can build rapport through learning active listening skills. The module places networking in the context of interpersonal skills. Nine discrete skills to develop active listening are discussed.

  - *Learning Styles:* An overview of four distinct learning styles and the potential strengths and weaknesses that can result from these styles. The index of learning styles include reflective or active learners (processing), sensing or intuitive learners (perception), visual or verbal learners (input), and sequential or global learners (understanding).

  - *Personality Styles:* A brief overview of different personality styles in terms of strengths and weaknesses. The Myers-Briggs Type Indicator (MBTI) test is used to provide psychological preferences for four categories with opposite pairs.

  - *Defining Purpose and Goals:* A brief overview on how to best define your personal purpose and goals to achieve maximum satisfaction. The module looks at the challenges of the 21st century workplace, and helps students to recognize their vocational calling and identity in pursuing goals.

  - *Written Communication in Technical Fields:* A brief overview of issues related to technical writing. The module defines key elements in technical writing and provides tips for making writing easier.

- *Engineering Ethics*

  - *Engineering Ethics:* A brief introduction to individual, professional and societal considerations. This modules examines micro- and macro-ethics in the context of individual, professional, and societal considerations.

  - *Virtue Ethics:* A brief introduction on using virtue ethics. This modules looks at methods to address ethics in engineering applications.

  - *Design of a Plow:* A micro-ethics case study in the consideration of values in designing a plow for a developing country. The module examines a situation where local resident values differ from the designer trying to help.

  - *Disaster Relief* – A micro-ethics case study on conflicting ethical issues in disaster situations. The module applies virtue ethics to a problem of competing interests in making decisions in a tsunami disaster relief situation.

  - *Design of a Chip* – A micro-ethics case study on balancing technical and economic considerations. The module applies virtue ethics to a problem of competing interests in making decisions with regards to truth in the design specifications of a computer chip.

An example of a professional development "Mini" module on "Informational Interviews" is shown in Figure 1. Note that the module includes only four slides: a title slide; an orientation slide, indicating where informational interview fit within the larger scope of inter-personal skills; an 'about' page, explaining what "Informational Interviewing" is and why it is important; and finally, (d) a "to do" slide, portraying what the interviewee should do before, during, and after an informational interview.

In some cases, it is beneficial for the local context to be included in the slides. In this case, a generic slide is included for the user to fill in followed by an example of a completed slide. An example of this is shown in Figure 2 for the "Mini" module, "The Influence of the Department/University Mission." Here, the instructor can use the slides as a template to include information about how the goals of the local university and department missions are related.

(a) Title page; this is a sub-topic of the 'Interviewing, Networks, and Building Relationships' "Full" module

(b) Orientation page; this shows where informational interviewing fits in with other inter-personal skills

(c) 'About' page; this slide explains what Informational Interviewing is and why it is important

(d) 'To do' page; this slide portrays what the interviewee should do for an informational interview

Figure 1: Slides from "Informational Interviewing" "Mini" Module

(a) Generic title page.

(b) Example of title page. Note local pictures can be used to connect students.

(c) Generic page to include the university mission.

(d) Example of university mission page. (Identifying information removed)

(e) Generic page to relate department mission to university mission

(f) Example of the relationship between the university and the department

(g) Generic page to show relationship between ABET and university goals

(h) Example of the relationship between the university and ABET goals

Figure 2: Slides from "The Influence of the Department/College/University Mission" "Mini" Module

Summary

This research effort was focused on the professional development modules. We have developed a template for and generated complete, polished modules for dissemination of professional development customized for engineering/STEM students. These modules included "full" modules targeted towards gateway engineering courses and "mini" modules, designed for use in capstone design courses. This paper highlights the development of the "mini" modules.

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