Undergraduate Nanobiotechnology Laboratory Experience at Worcester Polytechnic Institute

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The development of nanotechnology is driving a new wave of innovations and creating opportunities. One of the most promising areas of nanotechnology R&D is in human health care. The merging of biotechnology and nanoscience holds great promise for large-scale improvement of life and society. The next logical step is to connect these disciplines in education of scientists and engineers.

In 2011, faculty at the departments of Mechanical Engineering and Chemical Engineering at Worcester Polytechnic Institute introduced a Nanobiotechnology Laboratory Experience class for sophomores. The overall goal of the new course is to give undergraduate students the opportunity to learn nanobiotechnology through an inquiry-based module that students address in collaborative teams.

The class is organized based on Felder and Silverman's[3] 5-E Instructional Model which has students Engage, Explore, Explain, Elaborate and Evaluate to achieve the following objectives:

- Increase students' knowledge of Nanobiotechnology,
- Increase the skills of undergraduate engineering students in developing research methodology,
- Prepare students to deliver high-quality oral and written presentation projects,
- And enhance the interest and enthusiasm of undergraduate students for Nanobiotechnology.

Fifteen students completed the course, CHE/ME230x, offered for the first time during the Spring semester of the 2010-2011 academic year. Fourteen students are registered in this course during the Spring semester of the 2011-2012 academic year. Two WPI faculty members, one from the mechanical engineering (ME) department and one from the chemical engineering (CHE) department taught the course. The two professors complemented one another; one has experience in nanotechnology while the other has experience in bacterial adhesion.

There were four lab experiences in Spring 2011: sol-gel and dip-coating methods, electron microscopy, atomic force microscopy, and bacterial culture. Three lab experiences were scheduled in Spring 2012: sol-gel and dip-coating methods, electron microscopy, and bacterial culture. During class time students presented the results of their lab experiments so far and, with probing questions from faculty, discussed the findings, their implications, and successes

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[3] R.M. Feder and L.K. Silverman. Learning and teaching styles in engineering education, Engineering Education, 78 (1988), 674-681 (2002 preface).

and failures. Faculty also provided students with additional information related to nanobiotechnology and the procedures and equipment used. Teaching assistants helped students implement the lab experiences. At the end of the term, each group gave a PowerPoint presentation on their experience, summarized the steps that they went through to answer the question, reported results, and discussed implications and recommendations. Each group also created a brief video on one of the lab experiences. Four different lab videos were created.

In this presentation, the challenges and experience on offering such an interdisciplinary undergraduate laboratory course will be summarized. The evaluation results and students' feedbacks will be presented. The improvements and future work will be discussed.

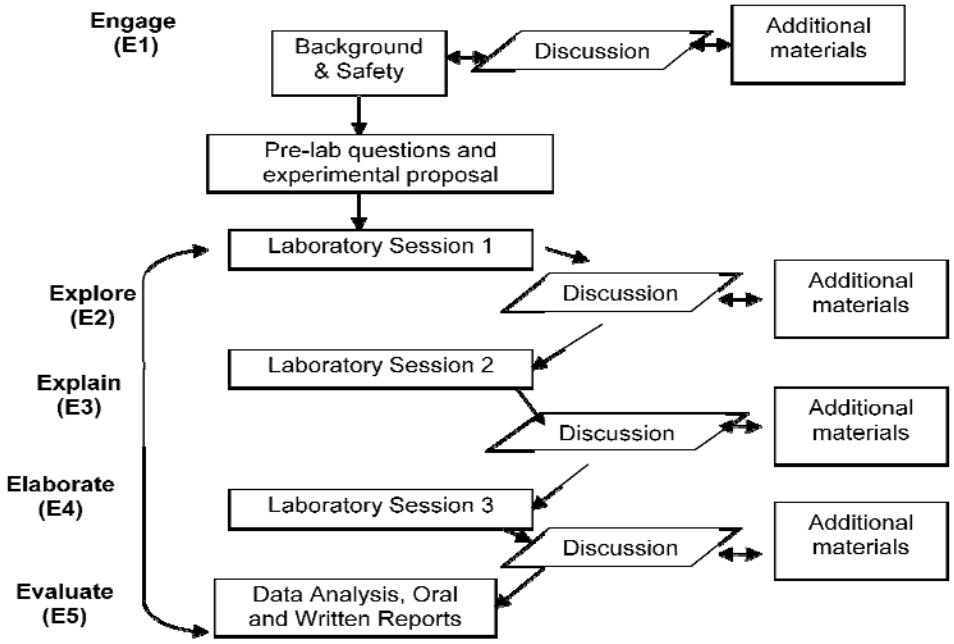

Figure: Schematic of 5E Instructional model that we applied in this laboratory course

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