Work in Progress - Preparation Creating Effective Faculty of Engineering: A Technological Literacy Approach

Mani Mina, Diane Rover, Mack Shelley
Iowa State University, mmina@iastate.edu, drover@mail.iastate.edu, mshelley@mail.iastate.edu

Abstract - This paper reviews the framework and provides new result for the implementation of a new program designed to develop more effective future faculty in engineering. The core of the proposed program will be based on our efforts regarding the recently developed Minor in Engineering Studies (MES). This program will team up effective engineering faculty to train, mentor, and evaluate a select group of graduate students to teach classes in our MES program. The goal is to help the engineering graduate students (the graduate educators) become better communicator and better educators by training non-engineering students in technological literacy classes. This practice is being introduced as a possible venue to develop and enhance the effectiveness of the graduate educators as classroom instructors and that therefore this is the way to train effective future faculty in engineering. This paper will introduce new results, and describe the new findings and developments in this project. In this paper we introduce the conceptual framework of the MES and the results of the early implementation of this study

Index Terms – Minor in engineering studies, technological literacy, technological literacy pedagogy

MOTIVATION FOR TECHNOLOGICAL LITERACY

Facing the future challenges facing this nation is hinged to prosperity of the residents of the United States , which are critically dependent on making wise choices on the use and further development of technology, addressing issues ranging from the formulation and implementation of energy policies to telecommunications. Addressing these fundamental issues is the mission of less than 2 million engineers. To enable the future engineering workforce, as well as to educate the public with essential information about technology and technological literacy, requires enhanced efforts to train more effective engineering educators. We believe we need engineering educators as well as other educators to team up and face the future challenges. The future engineering faculty at all levels will be responsible for educating their students as well as helping to educate non-engineers about technology[1-7]. We need to achieve effective technological literacy for the non-engineer 99.5% of U.S. citizens. This ratio is even more enhanced at a global level. Most of the country's leadership comes from this vast group of citizens who generally have only a vague understanding of the use of engineering and technology in the national interest. Engineering concepts are pervasive in decision making within industry, government, education, and health care, however, most decisions in these sectors are made by persons with little or no formal engineering or technologically related education. It is apparent that we need to develop new engineers, with a new roadmap to the future of engineering practice, engineering research, and engineering education.

SUMMARY OF THIS STUDY

This paper reports on the framework and implementation of a new program designed to develop more effective future faculty in engineering. The root of the program is based on our efforts regarding the recently developed Minor in Engineering Studies (MES). This program teams up effective engineering faculty to train, mentor, and evaluate a select group of graduate students to teach classes in our MES program. The objective is to help the graduate educator (engineering graduate students who would like to be in education) become better communicator and improve as educators by training non-engineering students in technological literacy classes. We believe that this practice will develop and enhance the effectiveness of the graduate educators as classroom instructors and that therefore this is the way to train effective future faculty in engineering. In this paper we introduce the conceptual framework of the MES and the results of the early implementation of this study. The following are the objectives of the program

- To create a new program designed to develop more effective future faculty in engineering.
- This is done by
  - providing a platform for the future faculty (graduate educator) to practice teaching
  - Provide an effective engineering faculty as a mentor to the students who would train mentor and evaluate the educator's progress
  - Establish an evaluation process that would assess the effectiveness and enhance the learning and growth for the graduate student
- Engineering graduate student s in this program
  - Become more effective communicators
  - Improve their teaching skills
  - Teach technology and related issues to non-engineering students

ASSESSMENT AND EVALUATION

In order to evaluate the progress of the graduate educators and their effectiveness, we have designed a set of assessment instruments that will focus on questionnaires for the students in the classes, the graduate educators, and the mentors.

Evaluation of the effectiveness of this program is directed toward measuring the extent to which it achieves intended outcomes for the graduate educator as well as students in the MES classes. These findings are to be used to refine and strengthen the program and MES activities, and are to be disseminated through presentations, publications, and NSF databases, with the goal of enabling future engineering faculty to be more effective educators, thereby creating the conditions by which both engineering and non-engineering students can become better informed regarding the use of technology and its social implications and thus better practitioners within their major disciplines.

The coded response options are:
1 = agree strongly
2 = agree somewhat
3 = disagree somewhat
4 = disagree strongly

The following are responses from graduate educator and student. We have questionnaire for faculty mentor and there are many written responses that are not included in this report.

	N	Mean	Std. Deviation
I feel that I understand the role of engineering in society	29	1.55	.506
I feel that I understand the interaction of engineering with my major field of study	29	1.34	.484
I feel that I can perform simple calculations and estimations using the engineering method	29	1.69	.761
I feel that I can make simple cost-benefit analyses	26	1.81	.749
I feel that I can make simple risk-benefit analyses	26	1.96	.824
I feel that I can appreciate the importance of the underlying assumptions used to produce the cost-benefit analyses presented by engineers	26	2.08	1.055
I feel that I can appreciate the importance of the underlying assumptions used to produce risk-benefit analyses presented by engineers	26	1.92	.891
I feel that I can make informed decisions about the desirability of engineering activities by weighing the benefits of those activities against their environmental risks.	29	1.90	.673
I feel that I understand the interdependence of the economic, environmental, and sociological aspects of technological change	28	1.71	.600
I feel that I can assess the validity and possible weaknesses in predictions of economic, environmental, and sociological consequences of technological change presented by others.	28	2.07	.604
I feel that I have a basic understanding of the engineering design process.	28	1.61	.685
I feel that I understand why particular materials and processes are used to produce simple engineering devices and systems.	29	1.97	.823
I feel that I understand the capabilities and limitations of basic manufacturing processes and engineering systems.	29	2.14	.915
Valid N (listwise)	26		

1=agree strongly, 2=agree somewhat, 3=disagree somewhat, 4=disagree strongly

CONCLUSIONS

This paper presents the concept and plan for a new training program, "Creating Effective Future Faculty in Engineering." This program is based on utilizing the most effective faculty at our institution as well as some of the national-level experts to help a select group of ambitious graduate students who aspire to become engineering faculty. The program is in the early stages of implementation. Upon mentoring the graduate educators and evaluating their performance, we will provide constructive feedback that will help the graduate educators improve their teaching effectiveness and become better and more effective educators.

R   REFERENCES

1. Augustine, N. (Chair), National Academies Committee on Prospering in the Global Economy of the 21st Century. 2005. *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, D.C.: National Academies Press.
2. Duderstadt, J. J. (Chair), National Academy of Engineering Committee to Assess the Capacity of the United States Engineering Research Enterprise. 2005. *Engineering Research and America's Future: Meetings the Challenges of Global Economy*. Washington, D.C.: National Academies Press.
3. Duderstadt, J. J. 2007. *The View from The Helm: Leading the American University during an Era of Change*. Ann Arbor, Michigan: University of Michigan Press.
4. Duderstadt, J. J. 2007. *Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research, and Education*. Ann Arbor, Michigan: University of Michigan Press.
5. Flanagan, J. L. 2006. U.S. competitiveness and the profession of engineering. *The Bent of Tau Beta Pi*, 16–22.
6. Galloway, P. D. 2007. *The 21st Century Engineer: A Proposal for Engineering Education Reform*. Reston, Virginia: American Society of Civil Engineering.
7. Jamieson, L. 2007. Engineering education in a changing world In IEC DesignCon. International Engineering Consortium, Chicago.

AUTHORS

Mani Mina is with the department of electrical and computer engineering at Iowa State University mmina@iastate.edu
Diane Rover is with the department of electrical and computer engineering at Iowa State University drover@mail.iastate.edu
Mack Shelley is with the departments of Statistics and Political Science at Iowa State University mshelley@mail.iastate.edu