Responding to Administrative Priorities

Promising Practices Supporting Institutional-Level Transformation of Undergraduate STEM Studies

***Capsule*:** Two reports commissioned for the National Academies' National Research Council Board of Science Education explore issues related to institutional-level transformation of undergraduate STEM studies through the implementation of promising practices. Their findings and recommendations may be of interest to administrators and faculty involved in educational reform projects.

***Summary*:** For Narum (2008), all instructional practices should be centered on determining what students should know and be able to do upon graduation. Desired student knowledge and skills should be considered from institutional, professional, and societal points of view. Administrative and instructional efforts should then be focused on fostering learning environments and instructional methods which will allow the accomplishment of the identified student learning goals. The "most effective promising practice" enabling systemic and sustainable institutional transformation efforts is for change agents to be "kaleidoscopic thinkers": to consider multiple alternative patterns for given sets of data, values and circumstances in order to develop viable solutions to presented challenges (p. 13). The solutions may challenge prevailing wisdom, but this type of creative problem solving is critical to successful transformation efforts.

Fairweather (2008), in the course of reporting on the progress of various initiatives, provides a review of the educational reform process, including challenges faced and recommendations for future projects. The long-time focus on improving individuals' instructional methods and the teaching-learning process has not resulted in a systemic understanding as to "the root causes of ineffective teaching and learning, low retention in the major and the declining pool of American students entering into STEM doctoral programs" (p. 3). The assumptions of earlier initiatives, such as the effectiveness of certain pedagogies is domain-specific, must be challenged if progress is to be made. Progress is also served by refocusing initiative goals. Improving student learning productivity will bring a higher return on investment than improving instructor effectiveness, and the easiest means of achieving that goal is the elimination of the worst instructional practices. For example, instructors who lecture to the exclusion of other instructional delivery methods should be encouraged to incorporate active learning activities into their lesson plans. Also, additional application research in well researched educational topics will yield only marginal benefits, since their efficacy has already been established. Rather, research should focus on strategies to get administrative and faculty adoption of instructional initiatives. Successful change strategies include the identification of key points where inattention to details can derail reform efforts and the determination of means by which to engage faculty whose main interest is not teaching.

***Implications for Engineering Education*:** Calls for reform in undergraduate STEM education have long been sounded, yet the traditional status quo perseveres. A successful transformation process is unlikely with underlying administrative and instructional policies supportive of the status quo still in place. For example, reward structures favoring research don't provide incentive for faculty who are not ordinarily invested in their teaching roles to be innovative in the classroom. Administrators are critical actors in establishing an environment in which success is possible through the promulgation of appropriate policies; in the case of this example, in establishing policies which reward success in teaching in equal measure with success in research, and ensuring adherence to those policies in promotion and tenure decisions.

References: James S. Fairweather (2008), "Linking Evidence and Promising Practices in Science, Technology, Engineering, and Mathematics (STEM) Undergraduate Education."

Jeanne L. Narum (2008), "Promising Practices in Undergraduate STEM Education."

Commissioned papers for the Evidence on Promising Practices for Undergraduate Science, Technology, Engineering, and Mathematics (STEM) Education Workshops sponsored by the National Academies' Board of Science Education.

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