

Chapter 1

Aligning Course Content, Assessment, and Delivery: Creating a Context for Outcome-Based Education

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ABSTRACT

The emphasis on Outcome-Based Education (OBE) and student-centered learning is an enormous advance in engineering education. The authors argue in this chapter that an essential element of OBE is aligning content, assessment, and delivery. The objective of this chapter is to provide a model for aligning course content with assessment and delivery that practitioners can use to inform the design or re-design of engineering courses. The purpose of this chapter is to help the reader build a foundation of knowledge, skills, and habits of mind or modes of thinking that facilitate the integration of content (or curriculum), assessment, and delivery (or instruction or pedagogy) for course, or program design. Rather than treat each of these areas separately, the authors strive to help the reader consider all three together in systematic way (Pellegrino, 2006). The approach is essentially an engineering design approach. That is, the chapter starts with requirements or specifications, emphasizes metrics, and then prepares prototypes that meet the requirements. It embraces the argument that “faculty members of the twenty-first-century college or university will find it necessary to set aside their roles as teachers and instead become designers of learning experiences, processes, and environments” (Duderstadt, 2008).

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AN ARGUMENT FOR THE ALIGNMENT OF CONTENT, ASSESSMENT, AND DELIVERY: OVERVIEW AND OBJECTIVE

Our approach is consistent with other initiatives to advance the state of the art of engineering education. The Scholarship of Teaching and Learning (SoTL) is receiving increased attention in higher education and many faculty are embracing more scholarly approaches to teaching and learning. Table 1 (adapted from Streveler, Borrego and Smith, 2007) covers the range of inquiry in engineering education. Levels 1, 2 and 3 were articulated by Hutchings and Shulman (1999). Level 0 was added by Jack Lohmann, and Level 4 was added by Streveler et al. (2007).

We agree with Wankat et al. (2002) and Copola (2011) that engineering faculty should work at Level 2 or above. Faculty practicing at Levels 4 will likely be a small fraction of the entire community; however, faculty practicing at Level 3 could be a large portion of the community. Aligning content with assessment and delivery is consistent with practice at Level 3. A goal of this chapter is to assist faculty in increasing the extent to which they take a scholarly approach to teaching and learning or advance along the levels of inquiry.

Table 1. Levels of inquiry in engineering education

Level	Description
0	Teach Teach as taught, without reflection
1	Effective Teaching Teach using accepted practices
2	Scholarly Teaching Assesses teaching and makes improvements
3	Scholarship of Teaching and Learning Engages in educational experimentation, shares results
4	Engineering Education Research Conducts educational research, publishes in archival journals

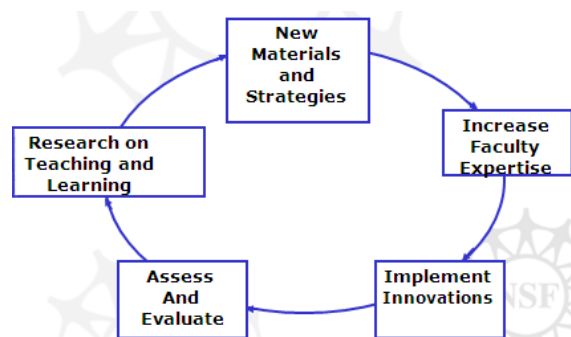
We are confident that the alignment of content (or curriculum), assessment, and delivery (or pedagogy or instructional strategy) to design learning modules, courses, and programs is pivotal to advancing the state of the art of practice in engineering education.

Our approach aligns with other models meant to increase innovation in engineering education. Two recent models embrace the cycle of improvement that “closes the loop” between research and practice. Figure 1 for example, was presented at a recent meeting of the US National Science Foundation (Boylan, 2011). Figure 2 comes from the Jamieson and Lohmann (2009) report on engineering education.

The framework we use in this chapter was developed in an engineering education PhD foundation course; Content, Assessment and Pedagogy: An Integrated Engineering Design Approach; that Streveler and Smith teach at Purdue. The chapter is also guided by a faculty workshop, Integrated Course Design for Outcomes Based Education (OBE), that authors Smith and Streveler facilitated for faculty at the Universiti Teknologi Malaysia (UTM) in May 2010.

A principal guide for this chapter is “Creating high-quality learning environments: Guidelines from research on *How People Learn*” (Bransford, Vye & Bateman, 2002). We chose this as our guide

Figure 1. Cyclic model for creating knowledge and improving practices in STEM education (Boylan, 2011)



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