Development and Implementation of Courses to Meet the Requirements of a Core Curriculum

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Abstract

Following the development and implementation of a core curriculum policy and requirement in the College of Technology at Purdue University, steps were undertaken to formalize a set of core courses. This paper examines the defining of three courses to meet the core requirements and describes the implementation process and challenges faced with the courses. The history of delivery of the courses is described through three iterations, including major revisions to course content, format, and delivery methods. The process of 'flipping' the introductory course from a traditional lecture format is also described. The paper concludes with a description of lessons learned and recommended best practices from our experiences.

Introduction

Following the lengthy and involved process of developing a core curriculum policy at the college level, the next challenge faced by the College of Technology was the defining and developing the three courses designated to meet the core requirements. With the adoption of the policy, all departments in the College instituted changes to their plans of study. These changes included the implementation of the three new courses from the core, the development of a gateway course that provides an overview of the field of study, and limitations on the number of major/discipline courses students can take during their first two semesters. The contents and implementation plans for the three core courses are described below.

Three Core Courses

Three main themes or focus areas arose out of the detailed process of defining the core goals from the College. These three areas centered on the concepts of the individual and technology, the global aspects of technology and its impacts, and leadership in technology fields and applications. The three courses that emerged from these groupings were: TECH 12000 – Technology and the Individual, TECH 32000 – Technology and the Global Society, and TECH 420 – Technology and the Organization. General content topics for these courses included the following:

TECH 12000: Introduction to technology, technology survival skills, learning/success skills, academic program information, data literacy, communication skills, introduction to ethics

TECH 32000: Global perspectives, cultural differences, societal context for change, multi-disciplinary teamwork

TECH 42000: Managing technology, managing in technological environments, project management, policy, systems thinking

The course numbers that were selected for the courses reflect where in the plans of study it was anticipated the courses would best fit – freshman year for the 100 level course, junior year for the 300 level offering, and senior year for the 400 level course. It was later decided to change the TECH 42000 course to TECH 32000, in order to expose the students to leadership experiences prior to their senior year. This change also caused the globalization-centered course to become renumbered to TECH 33000. The core curriculum was first implemented during the fall semester of 2011. Since this was the beginning of a new cohort of students, only TECH 12000 was offered during the fall 2011/spring 2012 academic year. The initial offering for TECH 32000 was held during the fall 2012 semester, and the TECH 33000 was first offered during the spring 2013 semester. Student enrollment for these courses is shown in Table 1. Due to the availability of six semesters of data, the remainder of this paper will discuss the evolution of the TECH 12000 course and the lessons learned from these experiences.

Course	Fall 2011	Spring 2012	Fall 2012	Spring 2013	Fall 2013
TECH 12000	521	267	554	207	581
TECH 32000	-	-	46	46	140
TECH 33000	-	-	-	53	22

Table 1. Student Enrollment in the Core Courses

Evolution of TECH 12000

The TECH 12000 course has undergone a number of significant changes during its short lifespan. As first envisioned and outlined during initial course planning during the fall 2010 and spring 2011 semesters, the course, destined for rollout during the fall 2011 semester, had the following topic areas:

- Introduction to technology
- Learning skills, styles, practices, and techniques
- Writing in technology
- Professionalism in technology
- Data literacy
- Technology today
- History of technology

- Success skills in technology careers
- Introduction to ethics in technology

The formal course description included the following:

> TECH 12000 is a survey course that develops a student's perspective and enhances their skills in living and working in a technological global society. The course explores the historical impact of technology, learning skills, oral/written communications, successful lifelong learning, problem solving or grand challenges, technology current events, data literacy, professionalism, and individual/global ethics.

The projected outcomes for the course reflected the broad nature of the items in the course description. The course was designated to be taught in a large lecture format, with classes meeting three times per week for 50 minutes each, or twice per week for 75 minutes each. All incoming freshmen to the College were required to take the class, as well as all students transferring into the College from other programs. The course was also available as an exploratory option for students who had not yet selected a major field of study. Guest speakers were identified and invited to participate to cover the many topics to a sufficient level. For the first semester of this course, there were four sections of approximately 130 students each, taught by four different instructors from four different departments in the College. The second semester that the course was offered, spring of 2012, consisted of two large lecture sections of 128 students and 139 students respectively. These two sections were taught by two of the instructors from the first semester, to provide consistency and experience in assessing the course's progress.

Although the first two semesters of the TECH 12000 course were successful, it was obvious to the instructors that there were significant problems in several areas, including content, course structure, and student involvement/interest. Content issues included too many topics that seemed to have no coherent overall goal. It became apparent that the course was trying to be 'too much to too many', and as a result, was not focused enough. It was decided that to achieve the necessary overall goal of providing a valid introduction to technology, secondary topic areas such as learning styles, 'how to survive in college', and professionalism needed to be jettisoned. This would allow for a deeper approach to the design process, creativity, and designing in context. Additionally, it was determined that the large lecture format needed to be modified in favor of an approach that would allow the students to be more engaged in active, project based learning, as well as small team interaction. This was accomplished through two techniques known as 'flipping' and 'blending'. The flipped classroom allows for large groups of students to be broken out into smaller, more interactive groups. This is accomplished through the development of online content and assignments that the students complete prior to class, with the in-class time reserved for high energy, fast paced small group interaction. The online interface provided a hybrid of distance and face-to-face instruction. The practical result of this modification was to transition from one section (130 students) of meeting in three large lectures per week to three small sections (40 students each) meeting once per week. These content and

format changes were first implemented in the fall 2012 semester, with very good results. Resources required to deliver the course remained fairly constant but student response measured by anecdotal stories and quantitative course evaluations indicted the changes were well received. The students (554) were much more engaged in learning, were able to successfully complete small group research projects, and took responsibility for their learning activities. It was also much more enjoyable for the course instructors to be involved in highly energetic, engaged student groups as opposed to a tepid large lecture passive learning environment. Modifications in content and use of in-class/out-of-class technology continued during the spring semester of 2013, with good success. During this semester, it was decided that the initial course description, structure, and content had changed to the extent that a new formal document was proposed to illustrate the current environment. The following changes were implemented for the fall 2013 semester (See Table 2):

	Original	**New**
Title	Technology and the Individual	Design Thinking in Technology
Description	TECH 12000 is a survey course that develops a student's perspective and enhances their skills in living and working in a technological global society. The course explores the historical impact of technology, learning skills, oral/written communications, successful lifelong learning, problem solving or grand challenges, technology current events, data literacy, professionalism, and individual/global ethics.	Students in this course will engage in critical analysis of real world problems and global challenges. They will demonstrate the ability to recognize opportunity and to take initiative in developing solutions applying the principles of human centered design. Students will be able to communicate effectively and to work well on teams. Problems and solutions will be examined from societal, cultural, and ethical perspectives.
Outcomes	1. Demonstrate foundational knowledge of technology as a career area 2. Demonstrate skills in the areas of time management, life balance, basic research, communication, teamwork, and problem solving 3. Identify personal learning style preferences 4. Develop an understanding of the history of technology and its impact on society 5. Demonstrate comprehension for current events in technology, basic technology regulations, and technology challenges that affect society 6. Demonstrate an understanding of	1. Students will be able to write a narrowly focused problem statement 2. Students will be able to apply ethnographic methods to understand technological problems 3. Students will be able to develop a search strategy, access technical data bases and evaluate results and source quality 4. Students will be able to create a technical report documenting results of the design process 5. Students will be able to manage design projects, develop project timelines and negotiate individual responsibilities and accountability in the team environment 6. Students will be able to apply strategies of ideation to develop novel and innovative solutions

	basic ethics concepts, personal responsibility, and ethical challenges in technology	7. Students will be able to rapidly prototype solutions for purposes of design, testing and communication

Table 2. TECH 12000 Course Modifications

Lessons Learned/Best Practices

There have been many lessons learned from this experience, including valuable insight gained regarding course content/focus, the use of innovative teaching methodologies to promote active learning, the effective use of technology inside and outside of the classroom, and creative approaches to dealing with limited resources when dealing with large numbers of students. Obviously, to be successful in a class of this nature, it is imperative to keep close control on the content. The topics must remain focused on the end goal in order to meet the defined objectives. We learned that this is an iterative process, with both outcomes and topical content changing over time. It may be necessary to experience failure, or at least lower than expected results, before finding the correct content combinations. Secondly, there are many ways to transform the classroom from the traditional lecture/large lecture format. Some of these models utilize lecture techniques supplemented with both out-of-class or in-class technology, some replace lecture, with alternative forms of instruction, and some combine many different aspects of instruction.

We recommend that novel approaches to instruction be investigated and seriously considered. The difference in student involvement and engagement that we have experienced through such a modification has been very noticeable and significant. Additionally, we have found that the creative use of technology in student assignments has been motivating to our students and most helpful in accomplishing instructional goals. We have effectively utilized online peer-to-peer evaluation tools, discussion boards, course management tools, and video (both instructionally and as a student project requirement). Finally, we have employed a creative solution to the instructional resource issue that was continually plaguing this course. With the large numbers of freshmen and transfer students required to take this class, there was the need for a minimum of four instructors from the college each fall and two for each spring semester. The commitment of the College to provide effective instructors in each section was not sustainable over the long term. To resolve this issue, a professor responsible for the technology teacher education program was placed in a supervisory position over the course. This individual provided careful mentoring to PhD students in the technology education program, empowering them to be section instructors for the class under his guidance. The TECH 12000 students are benefitted by having technology literate, motivated, and energetic instructors, while the instructors themselves benefit by gaining practical experience in a dynamic technology education setting. This resource model has been extremely successful and looks very promising as a long term solution to this issue for the College.