What Happened To This Course?

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Abstract – This paper chronicles the authors' initial surprise of the course content and, their reluctance to deviate or change from previously accepted course structure and material. Following this reaction the authors' understanding and subsequent acceptance of a course syllabus completely different from the accepted norm of freshman level common-core material. It illustrates the program coordinator's frustration of the department's failure and drop rates in the freshman common-core syllabus. The coordinator adopted a textbook with a completely different approach to introductory electronics. After three years using this textbook and corresponding syllabus changes, the student completion rates for this course significantly improved. This paper highlights the textbook differences, the related syllabus changes, the students' reactions and the subsequent results in the students' course completion rates over the last three years.

Keywords: Herrick, circuit analysis, new approach, freshman electronics

INTRODUCTION

From the fall semester of 1994 through the fall semester of 2002, the Electronics Engineering Technology program at The University of Memphis experienced a combined failure and withdrawal rate of 24.9%. On average, one out of every four students enrolled in the common-core course of Electronic Circuit Technology was either failing or withdrawing from the course. In some semesters, this figure was over fifty percent. Professor Scott Southall, program coordinator, discovered through student feedback that many of them were frustrated with the first-year course content and simply gave up. Professor Southall knew he had to change because the program to temper the student loss.

Background

The first-year course syllabus for Electronic Engineering Technology at The University of Memphis had not significantly changed significantly over twenty years. Prior to 1988, the freshman Electronic Circuit Technology course was a survey of fundamental electricity and electronics. The textbooks used covered DC fundamentals and associated laws with passive devices. Depending on the textbook of choice, the first semester curriculum normally included magnetism and the initial concept of AC. The second semester continued with simple reactive devices, complex numbers, right triangle trigonometry, and associated circuit analysis. The course was designed to serve as a core course for all engineering technology majors in five different concentrations. The Engineering Technology program was acutely aware of maintaining accreditation and thus followed the accepted common-core syllabus. Subsequent coursework for electronics and computer engineering technology majors did address more advanced topics in DC and AC circuit analysis.

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To accommodate expanded general education requirements in 1988, the survey-oriented nature of the freshman course changed and the course focus became DC and AC circuit analysis. This approach worked fairly well for a number of years. However, the declining math background of the students necessitated a review of the course content, as evidenced by the high failure/withdrawal rates. Adequately covering all necessary course topics became increasingly difficult because professors taught complex numbers, polar and rectangular notation, and associated mathematical problems in the first semester curriculum. However, the students were not able to see the practical applications of the classroom in a lab situation. Professors stressed that students should remember the basics and recall everything from the current semester to use in lab situations in following semesters.

SOLVING THE PROBLEM

The program re-introduced a circuit analysis course into the curriculum beginning with the 2002-03 academic year. Administration searched for a textbook for the freshman course that would provide the students with a better survey of the concepts as well as get them interested in electricity and electronics. In the fall of 2002, the faculty settled for a book that appeared adequate, but was really at a lower level than desired for a baccalaureate degree program. During the fall of 2002 semester, the program coordinator acquired a newly-published introductory circuit analysis textbook [Herrick, 1]. The textbook was the initial product of dedicated faculty at Purdue University who stepped back and re-thought how to make the entire four-year curriculum in their electronic engineering technology program better for the student because Purdue was also losing capable students due to some of the same circumstances. Currently, the author and associates are developing a complete series of books to cover the four-year undergraduate curriculum.

'Out-Of-The-Box' Textbook

The national syllabus norm in freshman year electronics engineering technology has been DC and AC circuits, consisting of passive devices (simple resistors, capacitors, and inductors), circuit analysis, and the associated mathematics in solving these circuits. Faculties have provided instruction over the same topics, with minor variations, for decades. Professors expect students to recall and apply everything taught in the freshman year without having had the benefit of hands-on experimentation to connect theory with reality. To quote the textbook author: "Even for the most gifted teachers and the most dedicated students, these two courses have become 'weed out' classes, where the message seems to be one of 'if you show enough perseverance, talent, and faith, we will eventually (later) show you the *good* stuff (i.e., the electronics')." [Herrick, 1]

New Curriculum

The Herrick textbook content still includes the standard norms, but dedicates additional chapters to Kirchhoff's Current and Voltage Laws. The text introduces Diodes, BJT, MOSFET, and Op Amp circuit applications even before the students encounter basic resistive series circuits. Once the students have been introduced to the resistive networks, biasing circuits are placed around the active device and those circuits, along with the DC parameters of the device, are used as additional examples of series DC circuits. Although these devices are not covered in depth, the students are given a chance to get applications experience which allows them to be exposed to these devices in the first semester of electronics. This gives the students an opportunity to see and better understand the importance of establishing a good foundation for their second year of studies. In essence, they get up-front physical exposure (however limited) which reinforces the interest and desire that originally lead them to the engineering technology field.

The decision to adopt the new textbook was made in the summer of 2003. The program coordinator's first priority was to modify the present syllabus while ensuring ABET compliance. This transition was accomplished quickly and easily. The subsequent submission and approval process for the new curriculum was completed by the fall of 2003.

Bringing New Faculty On Board

As one of the new faculty, this author, Jerry Newman, was one of two newly-hired experienced faculty members whose initial reaction to this new syllabus was absolute disbelief because the syllabus didn't make any sense when first exposed to it. We humans are creatures of habit and in this author's case, this teaching habit extended backward about thirty years. The first impression was that the students would be overwhelmed with this material because it came too fast. This author's colleague, Tom Banning, initially had the same mindset. After constant coaching from the program's coordinator and reading the textbook author's 'Preface', this new approach to captivating the students' interest and at the same time motivating them finally started to make sense. Full acceptance didn't occur until this author was able to observe first-hand the almost imperceptible change in the students' overall attitude a few weeks into the course. The big help was looking for that 'something different' from the expected norm that one had grown accustomed to.

Our first reaction to this new text and syllabus format was confusion because of the vast deviation from the traditional way that we had been teaching for over 30 years. We expected students to be overwhelmed with materials presented so quickly and in such quantity. After much coaching from the program director and after reading the preface to the text, however, we finally began to embrace the new approach to capturing the student's interest and thereby motivating them. We became a proponent of the new text and curriculum after observing a change in the students' overall attitudes a few weeks into the course.

Updating The Laboratory

Typically, change begets change, and this situation was no different. The freshman electronics laboratory had not been updated in approximately twenty years. The necessary analog trainers, oscilloscopes, function generators, and multi-meters were all present, but the laboratory was lacking in electronic devices consistent with the new textbook. For years the simple resistors, capacitors, and inductors had fulfilled the requirements of freshman year electronics. The new devices were ordered and laboratory assignments were completely rewritten.

CONCLUSION

The primary focus of this paper is not to center on the authors' experiences, but to highlight a textbook that has had a robust and positive impact on student learning capabilities. The heightened student interest in the freshman electronics engineering program is very exhilarating. Not every entering student is suited for engineering technology, however motivating students and encouraging interest in their chosen fields should be one of the primary goals of education. Today's students come from an environment of constantly changing technology. They have a tendency to become bored rather quickly. The failure /withdrawal rate of freshman engineering technology students fell significantly during the three-year period after adoption of this textbook and syllabus format. (See Table below)

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		Enrolled	Failed/ Withdrew	Failed/ Withdrew %
25 courses	Fall '02 - Fall '94	595	148	24.9%
7 courses	Spr '06 - Spr '03	186	27	14.5%

The entire engineering technology field would benefit from adopting the new approach and techniques of the Herrick text.

REFERENCES

[1] Herrick, Robert, *DC/AC Circuits and Electronics: Principles & Applications*, Delmar learning, Clifton Park, NY, 2003.

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The author earned an AAS Degree with a concentration in Electronic Technology from State Technical Institute at Memphis, a BS Degree with a concentration in Industrial Technology from Southern Illinois University, and an MS Degree with a concentration in Electronics Engineering Technology from The University of Memphis. His electronics experience includes 24 years of U.S. Navy service, as a training coordinator in an industrial engineering environment, and 11 years as a faculty member with both Central Texas College and Southwest Tennessee Community College. He joined The University of Memphis faculty full-time in the summer of 2006 and is now an Assistant Professor for the Electronics Engineering Technology program at The University of Memphis.

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