Assessing the Technology Management Preparation of Design Technologists

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Introduction

A longitudinal investigation into the technology management preparation of design technologists based on student performance on a technology management certification examination was begun in the spring of 2012. The objective was to ensure that all design technology graduates possessed an understanding of technology management practices in the areas of production, planning, and control; quality control; safety; and management specifically. The goal was to improve the level of understanding of technology management among graduating design technology graduates.

An initial study of the students' performance was completed in the spring of 2012[1]. In this study, the performance of design technology majors on their understanding of technology management was ascertained. The criterion for success included (a) a 91% pass rate for all who sat for the certification exam and (b) for those who did not pass the exam, the number of correctly answered exam items will fall within 10 correct answers of the passing score.

In this administration of the certification exam, 88.5% of the students passed. For those students who did not pass, all answered a sufficient number of exam items correctly to earn exam scores within 10 correct answers of the passing score. As well, it did not appear pursuit of a Business Administration minor by the students influenced certification exam performance.

In a post-exam survey, the students who sat for the exam noted that a variety of approaches were employed to prepare for the exam. While some prepared by themselves, most prepare with classmates. In response, actions taken (use of results) were identified and deployed based on what the students felt contributed to their performance. During the spring semester of 2013, which was when the certification exam was administered again, the students were informed of the approaches employed by the spring 2012 student in preparing for the exam.

This paper reports on the results of a subsequent study—the study of the spring semester of 2013 class—in which the outcome of the actions taken were examined and identified actions [to be] taken that, it is anticipated, will achieve the criterion for success.

Assessment framework. The following served as the framework for assessing the understanding of technology management by design technology majors:

Program Mission: The purpose of the BS in Design is to prepare individuals to apply technical skills to the management and creation of working drawings and computer simulations for a variety of applications. This shall include but will not be limited to instruction in specification interpretation, dimensioning techniques, drafting calculations, material estimation, technical communications, computer applications, and interpersonal communications.

Outcome: Graduates will exhibit an ability to understand professional, ethical, global, and social responsibilities.

Means of Assessment: The Association of Technology, Management, and Applied Engineering (ATMAE) Certified Technology Manager (CTM) certification exam.

Criterion for Success: Ninety-one percent of the BS in Design (architectural technology and mechanical technology) students who sit for the ATMAE CTM certification exam will pass the exam. The raw score for the students who do not pass will fall within 10 correct answers of the passing score.

Technology management preparation. The coursework that comprised the technology management preparation for design technology majors is depicted in Figure 1.

BS in Design w/o minor	BS in Design w/minor
• FINA 2244 Legal Environment of Business	• FINA 2244 Legal Environment of Business
• ITEC 3200 Introduction to Statistical Process Control	• FINA 3004 Survey of Financial Management
• ITEC 3290 Technical Writing	• ITEC 3290 Technical Writing
• ITEC 3292 Industrial Safety	• ITEC 3292 Industrial Safety
• ITEC 3300 Technology Project Management	• ITEC 3300 Technology Project Management
• ITEC 3800 Cost and Capital Project Analysis	• ITEC 4300 Quality Assurance Concepts
• ITEC 4293 Industrial Supervision	• MATH 2283 Statistics for Business
• ITEC 4300 Quality Assurance Concepts	• MGMT 3202 Fundamentals of Management
• PSYC 3241 Personnel and Industrial Psychology	• PSYC 3241 Personnel and Industrial Psychology

Figure 1. Technology management preparation for design technology majors.

Regardless of whether the design technology students elected to pursue the Business Management minor, they were required to fulfill a seven, three semester hour management courses requirement and complete two, three semester hour management related general education courses. The total technology management requirement consisted of 27 semester hours of coursework.

Method

The population for this longitudinal investigation was comprised of design technology majors pursing a BS in Design, enrolled in a required senior level design course. In order to develop a profile of the students and in an attempt to ascertain the readiness of the students, a pretest and survey were administered during the course's second class meeting. The students were only informed of the fact they needed to bring a bubble sheet and pencil for a pretest but were not informed of the nature of the pretest and survey.

The pretest was comprised of all 40 multiple choice items available in the certification exam study guide[2]: ten each from the four certification exam content areas. The forty-first item sought

information on whether the students were pursuing a minor and the remaining twelve items sought the status of management courses completion.

During the spring semester of 2013, the pretest and survey were once again administered and the class brief on the results. In addition, the 2013 students were briefed on the fact the 2012 students who sat for the certification exam noted that a variety of approaches were employed to prepare for the exam. While some prepared by themselves, the fact most prepare with classmates was emphasized.

Results

Pretest results. The pretest results for the two periods in which the pretest was administered are presented in Table 1.

Table 1. Pretest information.

Test information	Spring 2012 (n = 25)	Spring 2013 (n = 24*)
Mean	15.92	16.46
Median	16.00	16.00
Mode	14.00	16.00
Standard deviation	3.41	3.56
Variance	11.66	12.69

*One of the students enrolled in the course was not present the day the pretest was administered.

The pretest data were subjected to an F-test and t-test to determine whether there was a significant difference between the two classes—spring 2012 and spring 2013. It was concluded that the variances and means of the two classes were equal.

Survey results: management courses completed. The status of management course completion by the two classes—spring 2012 and spring 2013—are presented in Figures 2 and 3 respectively.

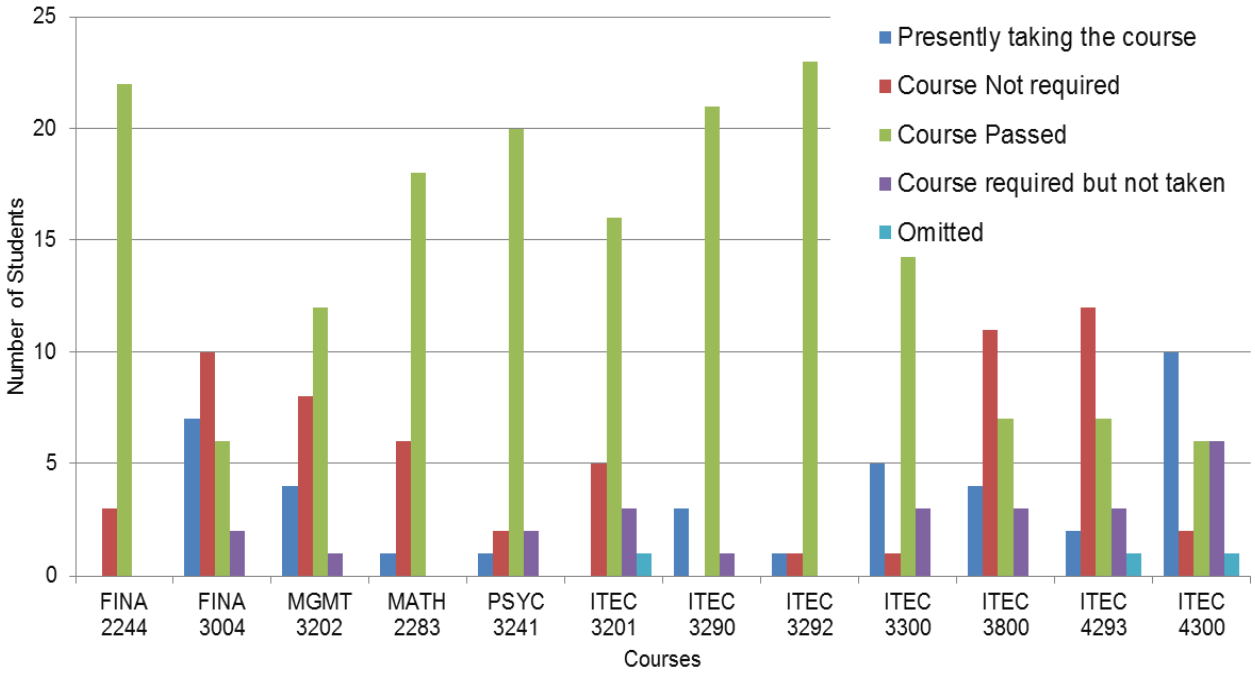

Figure 2. Management course completion, spring 2012[1].

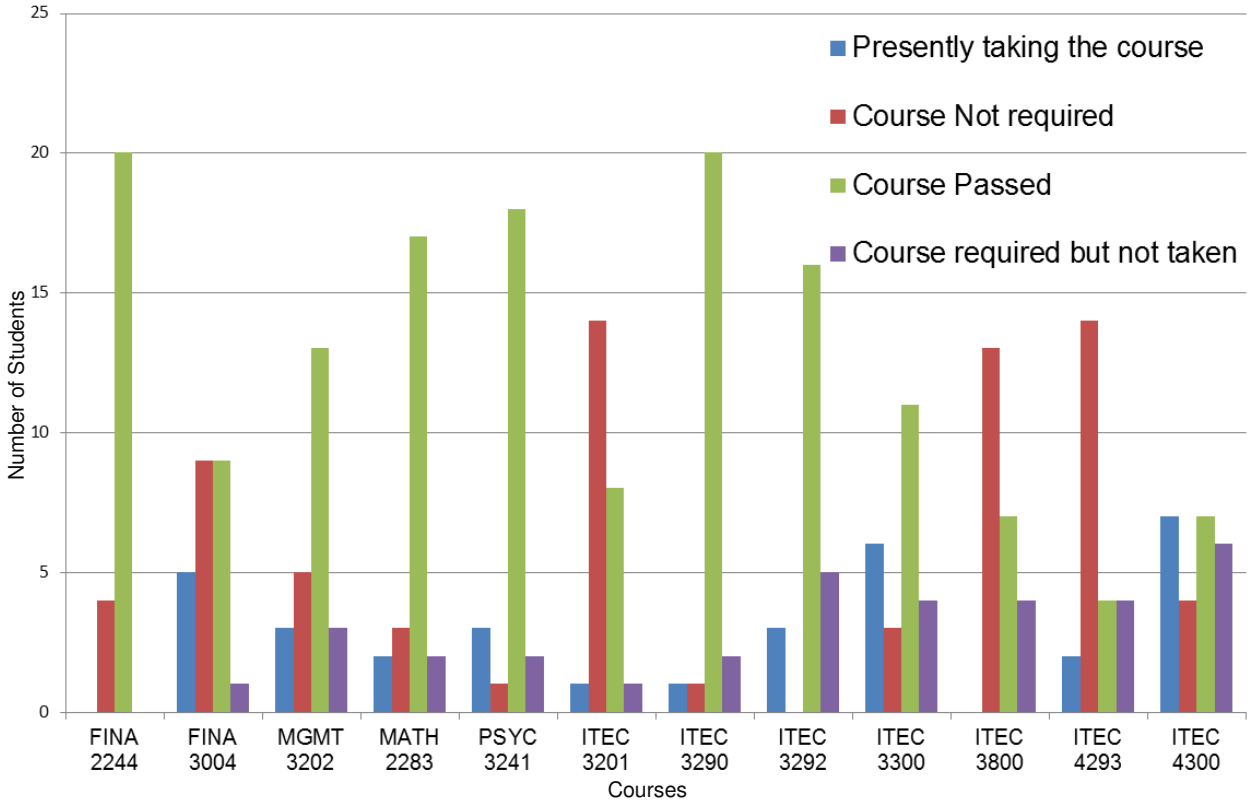

Figure 3. Management course completion, spring 2013.

In a visual inspection of the data, there does not appear to be a significant difference between the management course completion rate between the two classes—spring 2012 and spring 2013.

Survey results: choice of minors. The minors the students in the two classes—spring 2012 and spring 2013—were pursuing are presented in Figures 4 and 5 respectively.

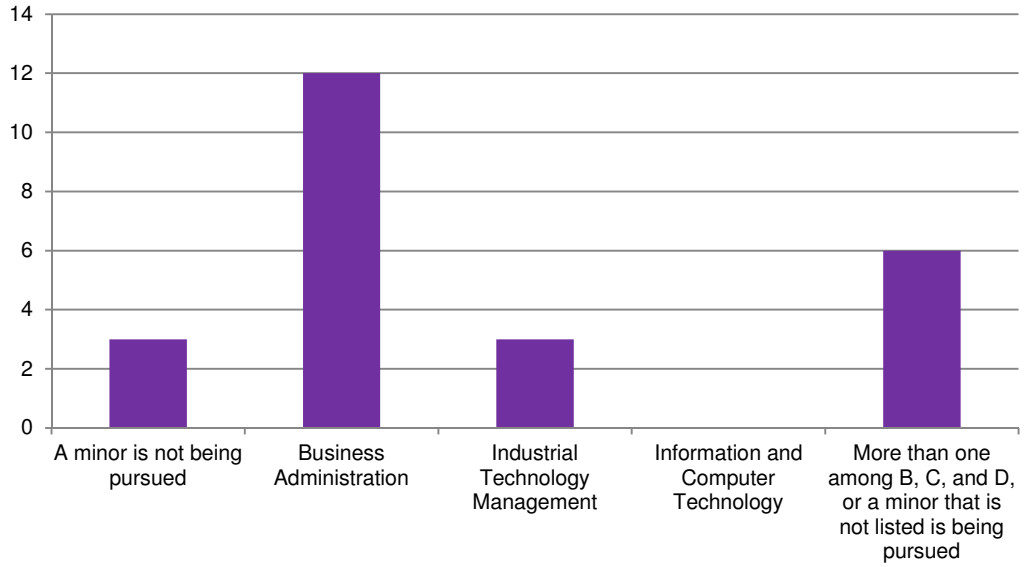

Figure 4. Minors being pursued by spring 2012 design technology students.

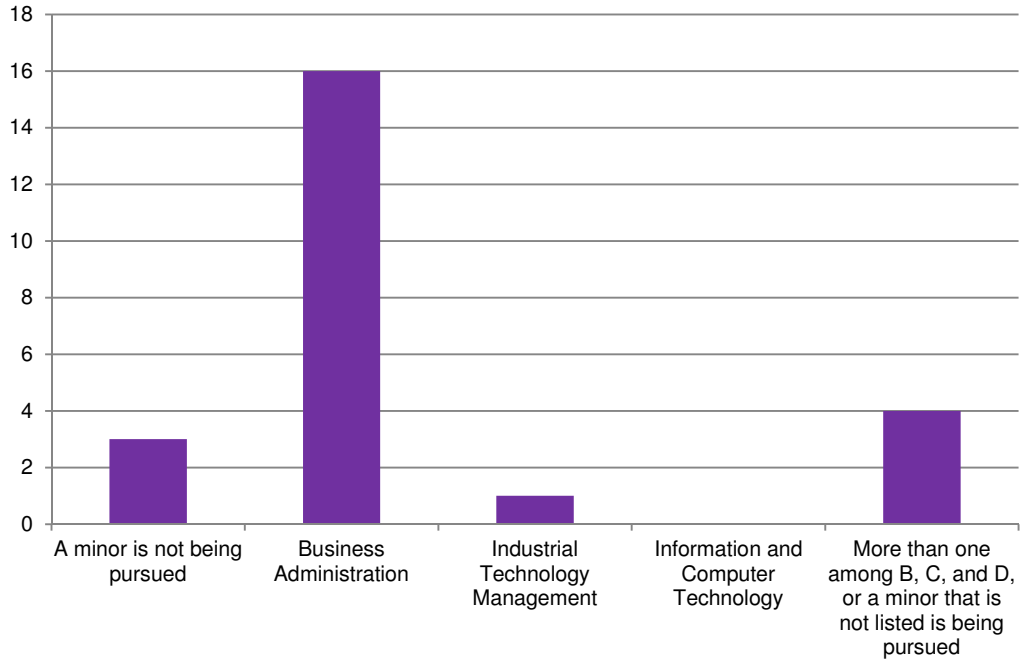

Figure 5. Minors being pursued by spring 2013 design technology students.

The significantly higher rate with which the Business Administration minor was being pursued is probably due to the value of the minor reported by alumni, the fact the BS in Design advisor encourages students to pursue a minor, and the perceived value of this particular minor in the students' academic preparation.

Spring 2013 exam results. During the 2013 spring semester, 21 of 25 students sat for the certification exam. Of the four who did not sit for the exam, three had already passed the exam. The fourth dropped the course.

Sixty-seven (67%) percent of the students passed (n=14) with threshold raw scores of 95 or better. The raw scores for 86% (6/7) the students who did not pass fell within 10 correct answers of the passing score (85-94). One of the students who did not pass, drop the course. Another who did not pass the exam took an incomplete for the course and eventually passed the certification exam and the course. The fact this student passed the exam is not reflected in these data.

As well, it did not appear pursuit of a Business Administration minor by the students influenced certification exam performance. The proportion of students pursuing a Business Administration minor who passed the exam was basically the same as the proportion of students pursuing some other minor or that were not pursuing a minor who passed the exam.

In a post-exam survey, 88% of the students indicated that they 'prepared' for the exam exclusively by themselves rather than with others, which is significantly higher than the more successful spring 2012 class. In addition, approximately 58% of the 2013 students reported needing to 'just fill in bubbles' to increase the likelihood of passing, which was the first time this approach to completing the exam was cited. That is, many ran out of time.

Discussion

The criterion for success for this program outcome was not achieved in the spring of 2013.

Actions [to be] taken (use of results). When this exam is be administered again—the 2014 spring semester—students will be more formally organized to 'prepare' for the exam. And even though an onscreen clock was provided by the test administrator, a greater effort will be made to provide students with countdown reminders while they are sitting for the exam.

Conclusions

Based on the students' performance on the pretest, it appears the courses completed and being completed by the students is not sufficient to sit for the exam. However, it should be noted that the pretest is a closed book, unannounced pretest, whereas the exam, while time constrained, is scheduled and is an open book exam. So there may be value in the administration of the pretest and the subsequent discussion of the results.

It appears there is no relationship between the pursuit of a given minor and the students' performance on the certification exam.

Bibliography

1. Chin, R. A. (2013). Management preparation of design technologists. *Proceedings of the ASEE | Engineering Design Graphics Division 68th Midyear Conference*, 96-103.
2. ATMAE. (2009). *Study Guide for the Certified Technology Manager (CTM) Certification Exam*. Retrieved from http://atmae.org/certif/CTMStudyGuide.pdf