Management Preparation of Design Technologists

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Abstract

An investigation into the management preparation of design technologists was begun. In this study, selected data were collected on the extent to which management coursework completed by students influenced the students' performance on a certified technology manager examination. Initial measures suggest the pursuit of a business administration minor and the extent to which students had completed management course work or were in the process of completing management course work had an impact on student performance on a certified technology manager examination.

Introduction

Because of its program objectives and outcomes, an Association of Technology, Management, and Applied Engineering (ATMAE) accredited BS in Design, requires its students to complete seven, three semester hour management courses in order to comply with its accreditation body's standards. In addition, the program also requires its students to complete a statistics course and an industrial psychology course, which are categorized as math and general education courses respectively by the accrediting body. The two however could just as easily be categorized as management courses by that same accrediting body.

By course title, the seven, three semester hour management courses required of the students are as follows:

FINA 2244 Legal Environment of Business

FINA 3004 Survey of Financial Management or ITEC 3800 Cost and Capital Project Analysis

ITEC 3290 Technical Writing

ITEC 3292 Industrial Safety

ITEC 3300 Technology Project Management

ITEC 4300 Quality Assurance Concepts

MGMT 3202 Fundamentals of Management or ITEC 4293 Industrial Supervision

The two additional three semester hour courses include MATH 2283 Statistics for Business or ITEC 3200 Introduction to Statistical Process Control and PSYC 3241 Personnel and Industrial Psychology.

By one of ATMAE's measures then, the BS in Design students are completing at least 27 semester hours of management course work even though the Program Structure & Course Sequencing standard only requires between 12-24 semester hours of management courses work (ATMAE, 2013).

In an attempt to ascertain the appropriateness and effectiveness of the management courses requirement, the BS in Design began requiring students taking a senior level design course to sit for ATMAE's certified technology manager (CTM) examination in 2012. While the CTM got its start with the formation of an ad-hoc certification committee in 1991, in its present state, the CTM exam had been deployed by the summer of 2001 according to Field and Rowe (2001). By 2009, an additional evaluation of the safety content of the CTM exam had been completed by Freeman, Field, Lott, and Schwab (2009).

The composition of today's CTM exam appears in Table 1. The exam items sub-categorized as Chemistry, English, Math, and Physics are a part of the Production category, and the exam items sub-categorized as Psychology are part of the Management category. A more detailed breakdown of the four exam categories appears in Appendix A.

Table 1. Category Breakdown.

Category	Question Count	Proportion
Production	64	40.0%
Chemistry	4	2.5%
English	3	1.9%
Math	19	11.9%
Physics	3	1.9%
Quality Control	24	15.0%
Industrial Safety	33	20.6%
Management	7	4.4%
Psychology	3	1.9%
Total	160	100%

The purpose of this study was to determine whether the BS in Design can reduce its management courses requirements and still produce effective graduates or possibly more effective graduates.

Method

The population for this study was comprised of twenty-six students pursuing a BS in Design. Thirteen of the students were pursuing an architectural technology concentration. Of the thirteen, one was double majoring in engineering. The remaining fourteen were pursuing a mechanical

technology concentration. Of the fourteen, two were pursuing a second concentration in architectural technology and two were pursuing a second major in industrial engineering technology. All students pursuing a BS in Design are required to fulfill a seven, three semester hour management courses requirement.

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 and 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: ten each from the four certification exam content areas. (ATMAE, 2009). 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.

Results

The performance of the students on the forty sample certification exam items is graphed in Figure 1. Based on the students' performance on the pretest, none would have passed the exam. A raw score of 24 or a 60% was required to pass the exam.

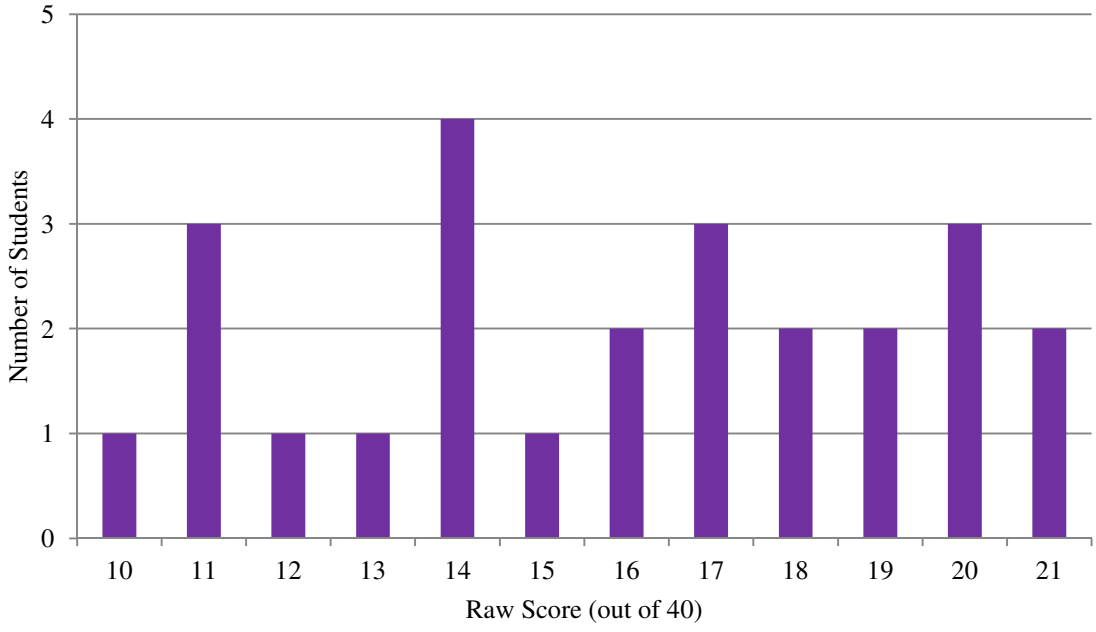

Figure 1. Student Pre-Test Performance.

Figure 2 reflects the minors the students were pursuing. At least 24 students were pursuing a minor. The majority of the students (12) were pursuing a minor in business administration.

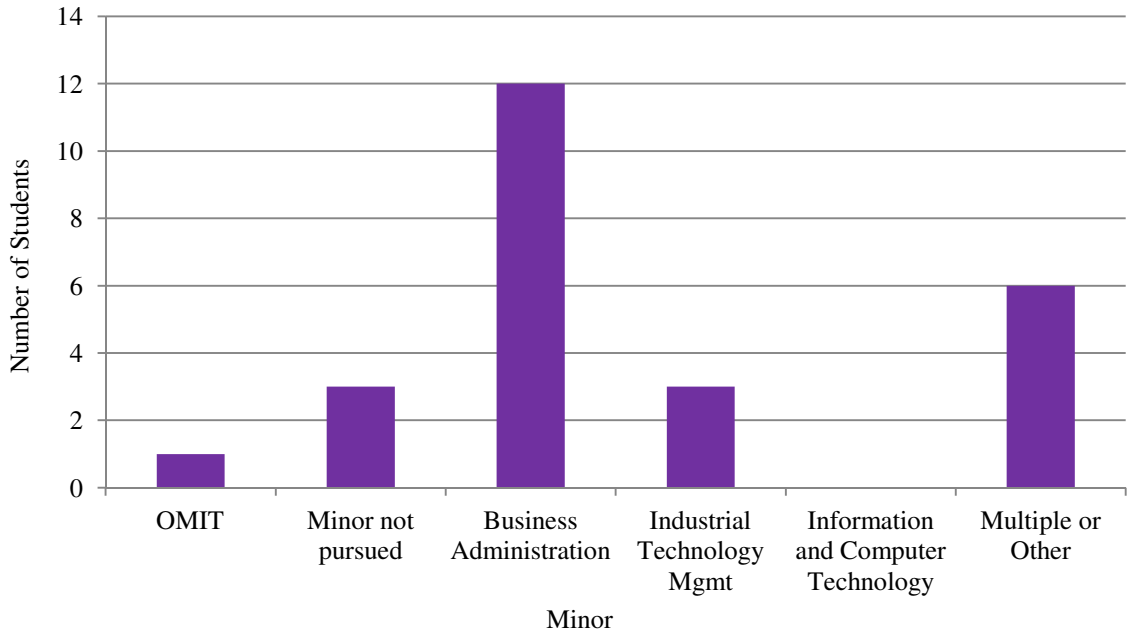

Figure 2. Minors Pursued by the Students.

The extent to which the 27 semester hours of what could be categorized as management course work was completed or in progress during the semester in which the students sat for the CTM exam is graphed in Figure 3. At a glance, one could conclude that the majority of the BS in Design students had fulfilled their management course work requirements or were in the process of completing those courses the semester they sat for the CTM exam.

Of those who sat for the exam, nineteen passed. During an optional retake, six of the seven who did not pass during the initial sitting chose to sit for a retake. Four of the six passed for an overall pass rate of 88.5%. Of those who did not pass, two were pursuing an architectural technology concentration, the other, a concentration in mechanical technology.

The performance of the twenty-six students who sat for the exam during the initial sitting is summarized in Table 2—Ques Count, Session Average, and Session Std Dev. The Current Year columns refer to the performance of all sitters of the exam the year in which the twenty-six students sat for the exam. The Historical columns refer to the performance of all sitters of the exam during the history of the exam.

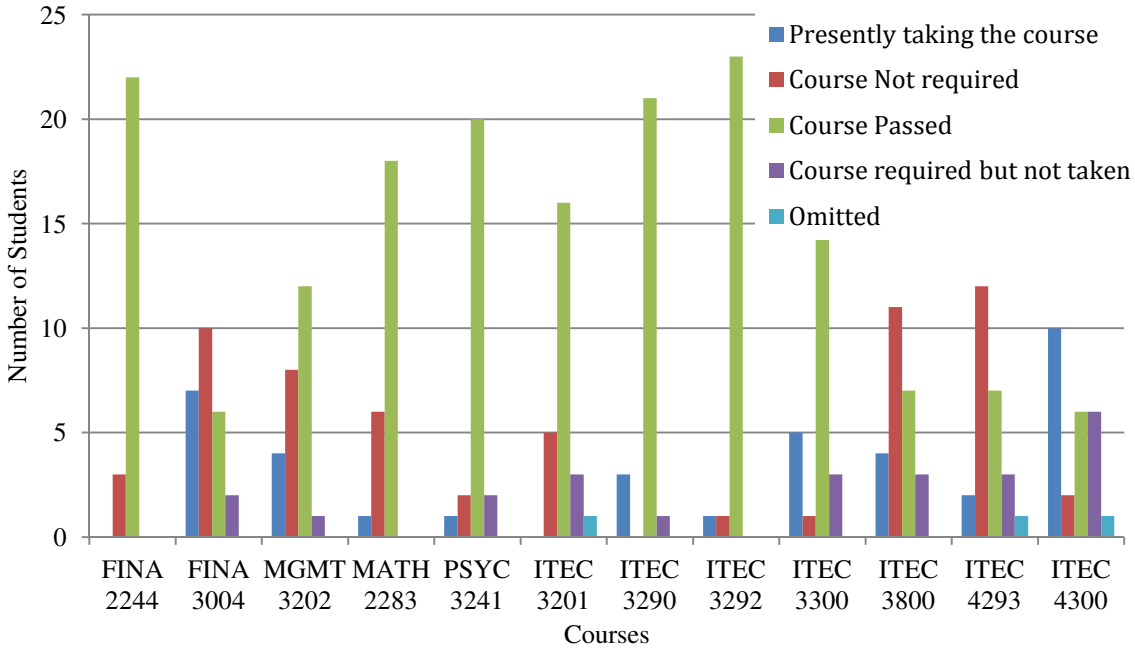

Figure 3. Completion of Management Courses.

Table 2. Performance on the Certified Technology Manager Exam.

Category	Ques Count	Session Average	Session Std Dev	Current Year Average	Current Year Std Dev	Historical Average	Historical Std Dev
Production	64	40.35	6.39	37.05	11.57	38.36	11.35
Chemistry	4	2.42	1.06	2.1	1.04	2.23	1.02
English	3	2.27	0.72	1.99	0.96	2.05	0.94
Math	19	11.73	2.16	9.79	3.74	10.23	3.72
Physics	3	1.23	0.91	1.07	0.94	1.08	0.92
Quality Control	24	12.12	2.88	10.38	4.26	10.79	4.27
Industrial Safety	33	21.73	5.62	19.55	6.2	19.95	6.07
Management	7	5.23	1.18	4.41	1.7	4.54	1.69
Psychology	3	1.69	1.01	1.47	0.99	1.52	1.01

The scatter plot—see Figure 4—characterizes the relationship between the students' pre-test scores and their exam scores. The correlation coefficient between the students' performance on the pre-test and the CTM exam was 0.1385. One student's score was not included in the tabulation due to the system timing out early. However, the student was permitted to complete the exam and passed. Another student's exam score, even though they passed the exam, was not included because they did not take the pre-test. It should be noted too, the pre-test was a closed book paper and pencil test with no time limit, whereas the CTM exam was an open book online exam with a 2 hour time limit. That is, the students had an average of 45 seconds to respond to each item.

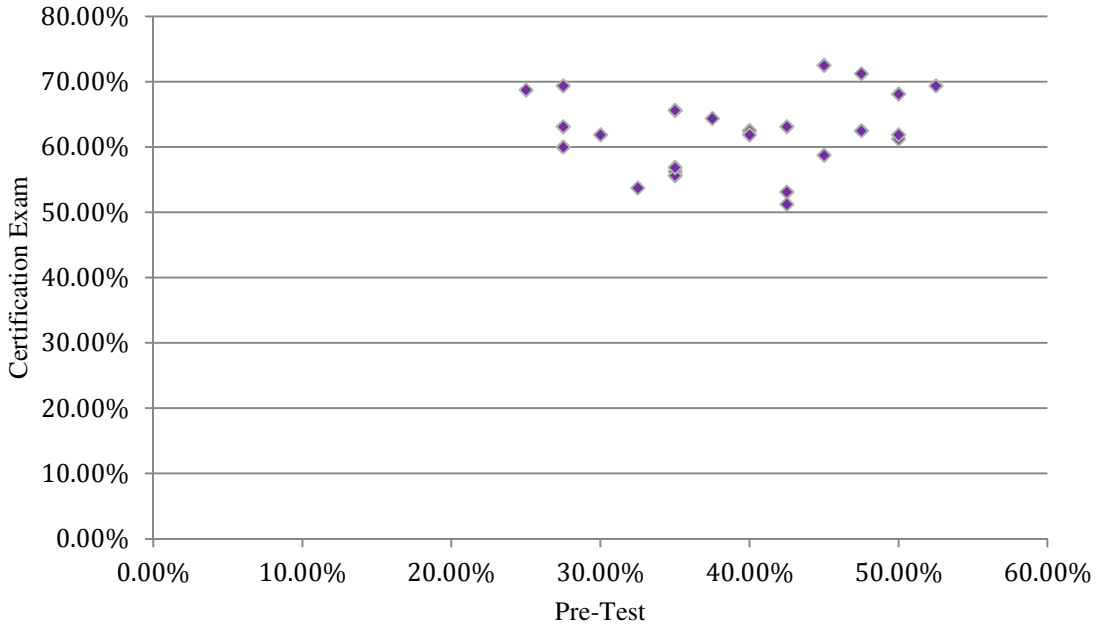

Figure 4. Relationship Between Student Pre-Test and Certification Exam Performance.

Discussion

Even though 27% of the students failed the exam during the initial sitting, overall the students who sat for the exam during the initial sitting performed better than all those who sat for the exam (a) during the current year and (b) for as long as the exam has been in existent. Student performance on the pretest, however, cannot be used to predict their performance on the CTM exam. But there may be value in making the students aware of their overall level of management knowledge. It however appears there may be a relationship between the management courses completed or in progress and the students' performance on the CTM exam. There may also be a relationship between the students' pursuit of a business administration minor and their performance on the CTM exam. It still remains to be seen whether the number of management courses required of BS in Design majors can be reduced.

An item analysis needs to be completed to ascertain the extent of content duplication among the management courses the BS in Design majors are required to complete to fulfill their graduation requirements. A survey of all the management course owners needs to be completed to determine the extent of duplication. Once the extent of duplication is acknowledged, an effort can be made to mitigate the replication in course work.

References

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Appendix A

Production, Planning and Control
- inventory management
- industrial organization structures
- production philosophies (JIT, MRP, KANBAN, Group Technology, etc.)
- production charts (process flow chart, Gantt, PERT, etc.)
- industrial waste
- preventative maintenance
- overhead vs. production costs
- laws regarding discrimination plant layout and materials handling
- patents, copyrights, trademarks, etc.
- material data safety sheets
- Environmental Protective Agency forms
- in-house vs. outsourcing
- labor standards
- purchasing
- locating industrial sites
- product life cycles
- inspection techniques
- forecasting
- fluid power
- time and motion study
- scientific management and some fundamental Physics, English, Economics, and Trigonometry

Quality Control
- basic statistics
- upper and lower control limits
- various QC charting methods (R-chart, p-chart, u-chart, np chart, etc.)
- sampling methods reliability
- variability
- attributes
- military standards
- distributions
- quality indicators
- types of errors
- probability
- QC curves

Safety
- OSHA regulations and history
- workers compensation
- industrial hygiene
- ergonomics
- safety inspections accident prevention
- ventilation
- personal protective equipment
- respiratory protection
- fire protection
- citations
- NIOSH

Management
- communication methods
- classes of human needs
- informal vs. formal information
- work motivation techniques
- human nature
- time and motion study
- communication methods
- classes of human needs
- informal vs. formal information
- work motivation techniques
- human nature
- time and motion study
- unions
- job evaluation
- history of work study
- business Law
- facilities layout & materials handling
- industrial communication industrial ergonomics
- industrial supervision
- leadership
- marketing
- management and behavior pioneers (Maslow, Herzberg, Mayo, Taylor, Gilbreath, etc.)