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ABSTRACT

The literature regarding the curricula of existing industrial/technology teacher education programs was reviewed to identify those courses that constitute the technical component of the industrial/technology teacher education programs currently being offered by U.S. colleges and universities. A survey was then conducted of the 133 institutions listed in the 1994 "Industrial Teacher Education Directory." Seventy-eight responses (a 58.6% response rate) were received from 33 states. Only 57 responses were deemed usable, however. Of those colleges/universities, 33 offered programs titled technology education and 24 included the descriptor "industrial" in their program title. The programs required a mean of 49.8 semester hours of technical courses; however, no common core of technical courses was identifiable. Only two courses were required by more than two-thirds of the colleges/universities. The curricula examined did not reflect current curriculum trends as identified in three recent studies published in 1991 and 1992. It was concluded that the identified lack of a consistent unified curriculum to prepare tomorrow's industrial/technology teacher education could have a devastating impact on the field. It was recommended that industrial/technology teacher education establish national teacher education standards addressing the discipline's technical content. (Contains 17 references.) (MN)

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A Reflective Examination of the Technical Content of Industrial Teacher Education

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As changes in industry and society effect industrial/technology education in today's secondary schools, these changes, along with national teacher education reform, also effect the curricular content of industrial/technology education. Teacher education programs have increased their graduation requirements and, in some cases, moved teacher certification to the graduate level. As noted by Lewis (1993), industrial/technology teacher education has been concerned with the increase of liberal studies into the teacher education curricula, thus squeezing out technical skill development. Bottrill (1991) noted, with regard to industrial/technology teacher education, that the educational reformists have focused on "education theory and have not kept pace with curriculum development in the field" (p. 6).

The competencies needed by industrial/technology education teachers have been categorized into three areas by W.R. Miller (1990). Miller identified those competencies as personal, professional, and technical. Curricula in some industrial/technology teacher education programs have been configured similarly. Henak (1991) classified the three program elements of industrial/technology teacher education as general education, professional education, and technical content.

The general education component, which in many cases is dictated by college and university graduation requirements, has been and continues to be discussed by all of teacher education (Reynolds, 1989; Wittrock, 1986). The professional preparation element related to industrial/technology teacher education was most recently examined by Zuga (1991). Zuga noted that 56% of the programs required only one course in curriculum development, while 31% offered two curriculum courses. Her research also indicated that 44% of the professional courses were not offered exclusively to industrial/technology education majors, but were taught to a combination of vocational education students.

Research related to the third teacher preparation element, technical competency, is lacking. Henak (1991) described a visionary profile of the technical content, however the current status of the technical content of industrial/ technology teacher education has not been identified. Educational reforms and industrial changes require that the technical content of industrial/technology teacher education be examined. This study was a reflective examination of the technical content of industrial/technology teacher education.

The term industrial/technology education is utilized throughout this study based on the findings of Zuga's (1991) research. Her survey results indicated that 34% of the field's

teacher education programs were entitled technology education, while 62% contained the descriptor industrial in the program title. Therefore, the title industrial/technology teacher education is used in this study.

Technical Content

According to Helsel and Jones (1986), the "technical sequence should provide the learner with opportunities and experiences in developing technical skills and knowledge" (p. 174). Henak (1991) noted that "the thrust of the content and activities [of the technical component] is on helping students understand impacts, processes, and outputs of present-day technical subsystems used in contemporary industry" (p. 11). Brown (1993) indicated that technical content should not focus on skill development, but it should increase the teacher education major's understanding about technology and its social and societal impacts. Henak identified a 48 credit hour component to develop these technical competencies. He grouped these technical competencies into biotechnology, communication, construction, manufacturing, and transportation.

C.D. Miller (1991) conducted a survey of leaders in the field of industrial/technology teacher education and his results indicated that the ideal program's technical component should

contain 45.6 credit hours. Finch, Schmidt, Oliver, and Yu (1991) surveyed 54 industrial/technology teacher education programs and noted a mean technical course requirement of 50.5 credit hours. However, no delineation of the types of technical course content was conducted.

Polette (1991) noted that traditionally the technical content of industrial/technology teacher education taught woodworking, metalworking, electricity/electronics, automotive mechanics, graphics, and mechanical drafting. He concluded that although contemporary content should include these technical skills, the focus should shift to include knowledge and skills used in communications, construction, manufacturing, and transportation. Lewis (1992) noted that innovative teacher education curricula included manufacturing, construction, transportation, and energy. Lewis concluded that programs categorized as traditional supported courses such as woodworking and metalworking in their teacher education programs.

Lewis (1992) further noted that the location in which the technical courses were taught has a statistically significant impact on the course's content. Technical courses taught outside of a college of education included social, political, moral, and economical aspects of technology and included less technical skill development. Finch et el. (1991) concluded that

64.2% of industrial/technology teacher education courses were completed outside of a college of education.

Purpose

The purpose of this study was to determine what courses comprise the technical component of industrial/technology teacher education programs currently being offered by the nation's colleges and universities.

Research Questions

More specifically, the research questions examined by this study were:

1. Is there a core of common courses that comprise the technical content of industrial/technology teacher education programs across the United States?

2. Is there a difference between the technical content required by teacher education programs with different program titles; technology education, industrial technology education, and industrial education?

3. Is there a difference between the technical content required by industrial/technology teacher education programs with regard to their location within or outside a college of education?

Methodology

Population and Sample

The population and sample for this research consisted of the 133 institutions listed in the Industrial Teacher Education Directory (Dennis, 1994) which offered undergraduate degrees in industrial technology education, technology education, industrial education, or industrial arts education.

A cover letter requesting the institution's program of study and a data gathering sheet were mailed to these 133 colleges and universities. The response rate was 58.6% (N=78). Responses were received from 33 states. Of those institutions responding, four had closed their industrial/ technology teacher education programs and 17 of the returned data sheets did not include a program of study. Those 21 colleges and universities were not utilized. Thus, the sample consisted of 57 responding colleges and universities which still offered an undergraduate teacher education program in technology education, industrial technology education, industrial arts education, or industrial education.

Data Analysis

Each universities" program of study and response sheet were examined to identify: 1) the title of the program, 2) the

location of the teacher education program, i.e.. college of education, college of engineering, college of technology, etc., 3) the titles of the required technical courses, and 4) the total number of required technical credit hours.

Thirty-three of the programs (57.9%) were titled technology education, while 42.1% (n=24) contained the descriptor industrial in their program title. This indicated a shift from the findings of Zuga (1991). Twelve programs (21.1%) were housed in a college of education, with 45 programs being housed outside a college of education. Forty-four (77.2%) of the industrial/technology teacher education programs taught the technical courses in their own department or program area.

The mean number of required technical credit hours was 49.8, with 48.0 credit hours being both the median and mode. The range of required technical credit hours was from 91 to 30 semester hours. Three programs (5.3%) did not have a prescribed technical component in their program of study. These institutions develop a technical course program for each industrial/technology teacher education major as needed.

Findings

The technical courses required by the responding industrial/technology teacher education programs are displayed in Table 1. Not one technical course was required by every responding college or university. The most commonly required technical course was electricity/electronics, which was required by 75.4% (n=43) of the institutions. Mechanical drafting, classified as traditional by Polette (1991), was the second most required technical course identified (n=38, 66.7%).

Insert Table 1 about here.

The technical courses suggested by Polette (1991) and Henak (1991), manufacturing and construction, were required by 63.2% and 49.1% of the teacher education programs respectively. Courses in graphics or desktop publishing were required in 56.1% (n=32) of the programs. Woodworking courses were required by 43.9% (n=25) of the colleges and universities. Computer-aided drafting was required by 40.4% (n=23) of the programs.

Hydraulics/pneumatics, biotechnology, and robotics, three contemporary technology courses, were listed at the bottom of the required technical courses. Hydraulics/pneumatics was

required by only three (5.3%) institutions, while biotechnology and robotics were included in only two (3.5%) industrial/ technology teacher education programs.

Table 2 shows an examination of the industrial/ technology teacher education programs by their title; technology education, industrial technology education, or industrial (studies, arts) education. The most consistently required technical course was electricity/electronics, required by programs which prepare industrial technology education teachers (92.9%).

Insert Table 2 about here.

Thirty-three percent (n=11) of technology teacher education programs required their majors to complete a communications course, while no industrial technology education or industrial education program required this technical course. Technology education programs were also more likely to include a transportation course (27.3%) than industrial technology education (7.1%) or industrial education (0.0%).

A course in plastics or composites is required by 40.0% of the industrial education programs, while only 3.0% of the technology education programs and 7.1% of the industrial

technology education programs required this technical class. Materials and processes courses were more likely to be required by industrial technology teacher education programs (50.0%) than industrial education programs (0.0%).

A comparison of the industrial/technology teacher education programs with relationship to their housing within or outside of a college of education is presented in Table 3. Overall, programs outside of a college of education indicated a greater percentage of technical course usage. Power and energy was required by 40.0% of programs outside of a college of education, while only required by 8.3% of programs in a college of education. No technical courses in transportation were required in college of education programs, while transportation was a part of 22.2% of non-college of education programs.

Insert Table 3 about here.

Conclusions

The results of this study indicated that industrial/ technology teacher education programs require a mean of 49.8 semester hours of technical courses. The data analysis noted a lack of a common core of technical courses, with only two

courses required by more than two-thirds of the colleges or universities. With regard to research question one, currently there appears to be no common core of technical courses required for an undergraduate teaching degree in industrial/ technology education.

Data indicated some difference between teacher education programs relevant to their program title, which should be expected. However, no substantial difference could be noted. Research question two, is there a difference between the technical content required by teacher education programs with different program titles; technology education, industrial technology education, and industrial education, would receive a negative response based on this survey's data analysis.

This study's results further indicated that the industrial/technology teacher education curricula did not reflect current curriculum trends as indicated by Lewis (1992), Polette (1991), and Henak (1991). Woodworking, mechanical drafting, and graphics were just as likely to be included in a technology education program as an industrial education program. While hydraulics/ pneumatics, robotics, and plastics/composites were more likely to be required by industrial education than a program entitled technology education.

In addressing research question three, an examination of Table 3 indicated that typically programs outside of a college of education had a higher percentage of technical course usage than programs housed in a college of education. According to Lewis (1992) these technical courses would contain less skill development and a greater emphasis on social, political, and economical aspects.

Also indicated was that a greater percentage of programs (78.9%) were housed outside of a college of education than the 64.2% noted by Finch et el. in 1991. Inferring from Volk's (1993) analysis, with only 12 of the industrial/technology teacher education programs housed in a college of education, the demise to the profession may indeed come about at the turn of the century.

The findings of this study indicated that the field of industrial/technology teacher education lacks a consistent unified technical program to prepare tomorrow's industrial/ technology education teachers. This lack of unification could have a devastating impact on the field, as graduates from it's teacher education programs do not contain a common base of technical competencies. Graduates, practicing teachers, and administrators will be left asking what is industrial/technology education, what does its curriculum entail, and how does it interact in today's educational system?

Recommendations

Industrial/technology teacher education must establish national teacher education standards addressing the discipline's technical content. Documents, such as Elements and Structure For a Model Undergraduate Technology Teacher Education Program (Henak, 1991), have not been utilized by the teacher education field. The root of this lack of implementation may stem from the non-acceptance of technology education by industrial education teachers (Rogers & Mahler, 1994).

Additionally, industrial/technology teacher education programs must fight to retain or reenter their teacher preparation programs into a college of education.

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Table 1

Required Technical Courses

Technical Course	n	Percent
Electricity/Electronics	43	75.4
Mechanical Drafting	38	66.7
Manufacturing	36	63.2
Graphics/Desktop Publishing	32	56.1
Construction	28	49.1
Woodworking	25	43.9
Computer-Aided Drafting	23	40.4
Power and Energy	19	33.3
Materials and Processes	18	31.6
Industrial Safety	13	22.8
Lab Management/Planning	13	22.8
Metalworking	12	21.1
Machine Tool Technology	11	19.3
Communications	11	19.3
Transportation	10	17.5
Automotive Mechanics	9	15.8
Introduction to Industrial/Tech	9	15.8
Welding	8	14.0
Plastics/Composites	6	10.5
Industrial Design	4	7.0
Hydraulics/Pneumatics	3	5.3
Robotics	2	3.5
Biotechnology	2	3.5

N = 57

Table 2

Required Technical Courses By Program Title

Technical Course	TE		ITE		Industrial	
	n	%	n	%	n	%
Electricity/Electronics	24	72.7	13	92.9	6	60.0
Mechanical Drafting	20	60.6	10	71.4	8	80.0
Manufacturing	23	69.7	10	71.4	3	30.0
Graphics/Desktop Publishing	18	54.5	8	57.1	6	60.0
Construction	20	60.6	5	35.7	3	30.0
Woodworking	11	33.3	7	50.0	7	70.0
Computer-Aided Drafting	12	36.4	6	42.9	5	50.0
Power and Energy	11	33.3	6	42.9	2	20.0
Materials and Processes	11	33.3	7	50.0	0	00.0
Industrial Safety	4	12.1	5	35.7	4	40.0
Lab Management/Planning	5	15.2	4	28.6	4	40.0
Metalworking	7	21.2	3	21.4	2	20.0
Machine Tool Technology	4	12.1	4	28.6	3	30.0
Communications	11	33.3	0	00.0	0	00.0
Transportation	9	27.3	1	7.1	0	00.0
Automotive Mechanics	4	12.1	2	14.3	3	30.0
Introduction to Industrial/Tech	4	12.1	4	28.6	1	10.0
Welding	2	6.1	4	28.6	2	20.0
Plastics/Composites	1	3.0	1	7.1	4	40.0
Industrial Design	2	6.1	1	7.1	1	10.0
Hydraulics/Pneumatics	0	00.0	0	00.0	3	30.0
Robotics	1	3.0	1	7.1	0	00.0
Biotechnology	2	6.1	0	00.0	0	00.0
	33		14		10	

Table 3

Required Technical Courses Relative To A College of Education

Technical Course	COE		Non-COE	
	n	%	n	%
Electricity/Electronics	7	58.3	36	80.0
Mechanical Drafting	6	50.0	32	71.1
Manufacturing	6	50.0	30	66.7
Graphics/Desktop Publishing	5	41.7	27	60.0
Construction	7	58.3	21	46.7
Woodworking	3	25.0	22	48.9
Computer-Aided Drafting	5	41.7	18	40.0
Power and Energy	1	8.3	18	40.0
Materials and Processes	2	16.7	16	35.6
Industrial Safety	2	16.7	11	24.4
Lab Management/Planning	3	25.0	12	26.7
Metalworking	3	25.0	9	20.0
Machine Tool Technology	2	16.7	9	20.0
Communications	2	16.7	9	20.0
Transportation	0	00.0	10	22.2
Automotive Mechanics	3	25.0	6	13.3
Introduction to Industrial/Tech	2	16.7	7	15.6
Welding	2	16.7	6	13.3
Plastics/Composites	1	8.3	5	11.1
Industrial Design	0	00.0	2	4.4
Hydraulics/Pneumatics	1	8.3	2	4.4
Robotics	0	00.0	2	4.4
Biotechnology	1	8.3	1	2.2
	n = 12		n = 45	