

Enrollment Trends in Industrial Arts/Technology Teacher Education From 1970-1990

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The field of industrial arts/technology education (IA/TE) has gone through considerable introspection and revision over the past twenty years. This process has taken place at both the public school and post-secondary level. College and university programs which prepare industrial arts/technology education teachers have instituted changes in curriculum, program requirements, and facilities. Universities which prepare IA/TE teachers have also witnessed a change in emphasis and program support to non-teaching options such as industrial technology.

Considering these changes, what has been the overall effectiveness and relative strength of programs which have prepared IA/TE teachers? Since 1970, when the first university renamed and restructured their program from industrial arts to technology education (Lauda & McCrory, 1986), to 1990 was the period of time on which this study focused. The purpose of this study was to determine enrollment trends in technology teacher preparation programs. Specifically, the study examined data related to:

1. The number of degrees granted (by type) within technology teacher preparation programs.
2. The number of technology education degrees granted by universities with and without industrial technology programs.
3. Whether there was a significant difference in the technology teacher preparation enrollment trends of those universities with and without industrial technology programs.

An examination of such data would help gauge the current enrollment of teacher preparation programs, inform policy makers of the potential implications of program emphases, and encourage dialog about future trends and direction of the discipline.

Influences on Industrial Arts/Technology Teacher Education Programs

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There have been two broad influences on industrial arts/technology teacher education programs since 1970. One influence centers on the philosophical change from industrial arts to technology education, while the other involves the expansion of non-teaching options such as industrial technology (IT). The following discussion of these influences provides a basis for the IA/TE teacher preparation program trends assessed.

The philosophical change from industrial arts to technology education has involved the renaming of programs, the restructuring of courses, and changes in facilities. Since the first program name change to technology education in 1970, over 30 programs listed in the *Industrial Teacher Education Directory* (Dennis, 1990) now contain such a descriptor. Courses have been restructured, with traditional industrial arts content as woodworking and drafting being replaced or reconceptualized into manufacturing and communications. Facilities have also witnessed changes due to the philosophical and programmatic shifts to technology education. However, despite this apparent shift in program philosophy, by the end of 1988 only 23.7% of the programs reviewed under ITEA/CTTE guidelines for technology education had full or conditional approval (Weins, 1990).

The creation and expansion of non-teaching programs such as industrial technology has been recognized for its instrumental role in shaping the scope and emphasis of IA/TE teacher preparation programs. As discussed by Sinn (1989), the history and evolution of industrial technology programs was based on industrial arts education. The development of non-teaching IT options were due to faculty and administrative action at various institutions. Oaks and Loepp (1989) indicated this shift away from teacher preparation programs was a result of a desire by IA/TE-based departments to continue enrollments, while serving a new diversified population with different career goals. In this manner, students who did not enter the teaching profession after degrees in IA/TE were targeted in these new programs.

Oaks and Loepp also indicated the shift in emphasis toward nonteaching areas created problems with IA/TE programs nation-wide. They found IT program emphasis resulted in an erosion of support and recognition for IA/TE programs. With only 42% of the teacher preparation programs listed in the *Industrial Teacher Education Directory* (Dennis, 1990) being located in schools of education, matters of program attention and allegiance may be skewed. Bott (1988) provided an example of this reduced support. Bott compared vocational education programs located in schools of education with those located in schools of engineering or technology and concluded that in areas such as budgets, programs in schools of education received greater support.

Rudisill (1987) also noted the chaos and conflict caused by the factionalism between IA/TE and IT programs. He indicated technology educators no longer control the technical content courses, making the implementation of new recommended curriculum difficult. In this way, the IT spin-off from teacher education programs usurped the original program's mission and power.

The philosophical change from industrial arts to technology education and the expansion of non-teaching options have influenced programs which prepare technology teachers. It was determined an examination of industrial arts/technology program enrollment trends would help clarify questions as to the extent of such influences. Also, an examination of the past and present program indices would provide a base from which to project future program trends.

Methodology

To examine the enrollment trends of industrial arts/technology teacher education programs from 1970 to 1990, data contained in the *Industrial Teacher Education Directory* (Dennis, 1975; Dennis, 1980; Dennis, 1985; Dennis, 1990; Wall, 1970) was analyzed at five year intervals. Information within these sources included the number of industrial arts/technology education graduates; graduates with other degrees such as vocational education, industrial technology, and construction management; and faculty characteristics. The appropriateness of using directories for quantitative analysis related to IA/TE was demonstrated by Edmunds (1990), Moss (1989) and Wright (1986). Recognizing the limitations of basing historical trends on secondary sources (Isaac & Michael, 1987; Mason & Bramble, 1989), an attempt was made to minimize their effects on the integrity of the study. A main concern of using such data was the internal criticisms of document meaning and trustworthiness. Meaning refers to the way the document was interpreted; trustworthiness deals with the accuracy of the information provided.

The meaning of the categories of information provided in the *Directories* was of paramount concern to the author. Kaestle (1988) cautioned on the problems of examining certain educational variables that may have alternate definitions in different periods, or omitted from the report. Wall (1970), as compiler of the first *Directory* examined, also cautioned about this ambiguity when he stated "the listing of the major, because of different meanings attached to terminology, may not mean the same thing" (p. i). To increase the meaning of the *Directories*, the following steps were taken:

- Intra-directory differences in *Directory* labels were minimized with degree offerings divided into two broad categories: those involved with the preparation of teachers for general education programs in industrial arts/technology education, and those concerned with other vocational fields and non-teaching options.
- Inter-directory differences were minimized by comparing each institution's subsequent entry with the previous entry for changes in program name, degree classification, and program areas.
- Missing data for existing programs were estimated by the mean from the most prior and subsequent directories, following the recommendation of Borg & Gall (1989).

The trustworthiness of the secondary historical documents was also recognized as an important concern. Best & Kahn (1989) noted the relative worth or accuracy of such documents and asked whether the writers of secondary sources were competent, honest and unbiased. This study recognized that the information provided by the various departments listed in the *Directory* did not necessarily guarantee honesty nor accuracy. It was also quite possible that some of the information provided by universities may imply program strengths and hide program deficiencies by creative use of numbers. For instance, faculty numbers may include adjunct or emeriti professors, leading to the assumption of full-time positions. To increase the trustworthiness of the *Directories*, the following action was taken:

- When inter-directory inconsistencies appeared, such as when total program graduates increased dramatically while faculty numbers declined, an attempt was made to check the validity of the data (Englehart, 1972). Eighteen programs were identified as having such inconsistencies. A letter was then sent to a professor listed commonly in the first and last *Directories* requesting verification of the numbers for their programs. Eighteen respondents (100%) confirmed or amended the information.

Findings

Between 1970 and 1990, universities with industrial arts/technology education programs experienced considerable change in the number and type of degrees granted. Based on the data reported in the *Industrial Teacher Education Directories* in five year intervals from 1970 to 1990, several broad trends were observed. The findings are provided in the following sections.

University Programs

Table 1 provides information on the number of graduates from universities which offer programs in industrial arts/technology education. The total number of universities identified in the *Directory* providing programs in IA/TE decreased 14.7% from 1970 to 1990. When the number of universities reporting no bachelor degrees awarded for their program in the 1990 *Directory* is included, the resulting decline of universities producing IA/TE teachers since 1970 was 24.1%.

Table 1

Graduates From University Departments Which Offer Programs in Industrial Arts/Technology Education

Year	<i>n</i>	BA/BS	IA/TE Degrees			Non-IA/TE Degrees
			MS/MEd	EdD/PhD	Total	Total
1970	203	6368	1767	83	8218	894
1975	204	6371	1918	75	8364	1478
1980	205	5048	1353	73	6474	1453
1985	198	2668	931	51	3650	7725
1990	174	1790	650	50	2490	7063

The number of graduates prepared to enter the teaching field also decreased dramatically during this time. Between 1970 and 1990, there were 71.9% fewer bachelors degrees awarded, 63.2% fewer masters degrees, and 40.0% fewer doctorates. The rate of decline for all IA/TE majors was 69.7%. However, non-IA/TE degrees increased by 790.0% (87.4% fewer non-IA/TE degrees were awarded in 1970 than in 1990). This latter increase was due in great part to the explosive growth and shift in emphasis to industrial technology program options. Despite the decreased numbers enrolled in teaching programs, the shift to non-IA/TE options appears to maintain the number of total students enrolled in such university programs. Figure 1 shows the general trends of graduates with IA/TE and non-IA/TE options as well as total enrollments from universities with programs in industrial arts/technology education.

Figure 1. Degrees granted (by type)

Effects of IT Programs on IA/TE

To examine the effect industrial technology (IT) options had on IA/TE programs, the number of IA/TE graduates from universities with IT programs were compared with those that do not. The 1990 *Directory* descriptors for each university were used to identify and categorize such program offerings. Table 2 shows the graduation rates for IA/TE majors from these two program designs.

An examination of the IA/TE graduation rates from 1970 to 1990 found that programs without the IT option declined 52.9%; while those with the IT option declined 72.7%. It is interesting to note that during a similar time period, undergraduate education degrees for all disciplines decreased 54.9%, (*Digest of Education Statistics*, 1991) very similar to programs without the IT option.

Table 2

Industrial Arts/Technology Education Graduates From University Departments With and Without Programs in Industrial Technology

Program	Year					(N)	%Dec.
	1970	1975	1980	1985	1990		
IA/TE With IT	5812	5781	4349	2156	1586	(123)	72.7
IA/TE Without IT	1914	2136	1990	1487	901	(73)	52.9

The student means from programs with and without the IT option were examined. These data were used to further define the trends between the two programs. Table 3 shows the means and standard deviations for IA/TE students and non-IA/TE students from universities which offer the IT program option.

These data indicated the change in student numbers was not equal between the two groups. In general terms, the mean number of IA/TE graduates decreased, while the non- IA/TE graduates increased.

Table 3

Means and Standard Deviations of Graduates From Programs With the Industrial Technology Option

Year	IA/TE Students			Non-IA/TE Students		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
1970	51.2	43.6	113	13.5	16.2	31
1975	50.0	45.6	115	23.9	26.9	39
1980	36.8	37.5	117	23.8	31.5	43
1985	18.0	21.6	119	65.3	80.2	105
1990	13.3	18.5	119	56.9	71.9	113

Table 4 shows the means for graduates from university programs with no IT option. These data indicated that from universities which do not offer IT program options, there were both fewer IA/TE graduates and non-IA/TE graduates.

Table 4

Means and Standard Deviations of Graduates From Programs With No Industrial Technology Option

Year	IA/TE Students			Non-IA/TE Students		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
1970	29.9	29.2	59	22.1	21.2	18
1975	31.9	30.9	61	22.4	23.4	20
1980	29.5	26.4	64	14.2	10.1	22
1985	22.5	27.0	64	19.9	18.4	35
1990	14.0	18.7	64	17.6	19.4	33

To determine if there was a significant difference in the magnitude of change between the number of students graduating from the two types of programs (with IT program option, no IT program option) from 1970 to 1990, a one-way analysis of variance (ANOVA) based on a split plot factorial design (Kirk, 1982) was performed. The dependent variables of IA/TE graduates and non- IA/TE graduates were used for this procedure. A contrast/contrast interaction was also performed for the years 1970 and 1990.

The ANOVA summary table with IA/TE graduates as the dependent variable is presented in Table 5. A significant difference was found between the university programs with and without the IT option ($F_{1,704} = 20.96$, $p = .0001$).

Table 5

ANOVA Summary Table With the Log of IA/TE Graduates as the Dependent Variable

		SSQ	F	p
Type	1	3.02	9.18	.0025
error	181	591.49		
Year	4	190.60	144.81	.0000
Year*Type	4	16.51	12.54	.0001
error	704	231.64		

The ANOVA summary table for non-IA/TE graduates as the dependent variable is presented in Table 6. A significant difference in the change in enrollment (graduates) was also found between the two programs ($F_{1,293} = 51.99$, $p = .0001$).

Table 6

ANOVA Summary Table With the Log of Non-IA/TE Graduates as the Dependent Variable

		SSQ	F	p
Type	1	0.34	0.61	.4352
error	156	410.74		
Year	4	28.75	13.07	.0001
Year*Type	4	37.81	17.19	.0001
error	293	161.16		

Conclusions

The conclusions of this study were derived from the findings and are dependent on the limitations noted for document meaning and trustworthiness. This study indicated five general trends:

1. The number of universities offering IA/TE programs has decreased since 1970.
2. The number of graduates prepared to enter the teaching field as industrial arts/technology education teachers has declined.
3. The number of non-IA/TE majors graduating from expanded programs areas such as industrial technology has increased, resulting in fairly constant total student numbers for university departments.
4. The decline in IA/TE graduates from universities which do not offer industrial technology program options was consistent with the national trends for all areas of teacher education.
5. The decline in IA/TE graduates from those universities offering industrial technology programs has been significantly greater than those that do not offer such options.

Implications

Considering the observed trends in program numbers and options, the future growth, success, and very existence of many university programs which produce IA/TE teachers is in doubt. There are several reasons for such skepticism.

Program Strength

The data indicated a trend toward fewer students interested in becoming IA/TE teachers. This trend is not salient to only IA/TE professionals. Poor working conditions, job stress, and poor salaries have been identified as contributing factors to attracting and retaining teachers from all subject areas (Metropolitan Life, 1985). However, given the alternate opportunities available to IA/TE majors with non-teaching options, the similarities with other specific subject areas which have recruitment problems: i.e., science and mathematics, is evident. Science and mathematics have allies in their role as a necessary component in public educational institutions, whereas IA/TE has not been championed to the same extent. The trends indicated that the few students enrolling in IA/TE teacher preparation programs may not justify the continued existence of programs despite their past popularity and health. The current economic conditions facing many universities may also exacerbate the demise of these programs.

Program Compatibility

The change in emphasis and growth of IT offerings may be in conflict with the established role and mission of universities that once had a traditional emphasis on teacher preparation. Again, political and economic considerations may have university administrators examining the continuation of such non-teaching programs. Should the now-dominant IT programs which exist in many universities belong in the College of Education, or does the teacher education component belong in a College of Technology; divorced from their pedagogical counterparts? Already, shifts in departmental structure can be observed in universities, with technical components being separated from the teacher preparatory component. Programs at institutions such as East Carolina University and Georgia Southern illustrate this trend. With this separation, IT programs have formed their own identity and justification for existence, independent from the pedagogy of IA/TE.

Program Viability

The technical component of university IA/TE programs which increased their emphasis on IT may be in competition with other programs or those technical programs within the university, or offered at the community college level. In the former situation, IT may not automatically be considered an engineering discipline, thus being in conflict with those universities having established engineering programs. If one mission of an IT program is to develop middle-management and technically-competent individuals for areas such as construction management and manufacturing technology, then it is quite possible the facilities and opportunities available through community colleges may adequately address these needs. The new emphasis in federal funding for 2+2 programs and Tech Prep may further accelerate the position of community colleges to deliver state-of-the-art technologies. With this scenario, university IT programs may find themselves concentrating on students only in their last two years of a bachelor's degree.

An ancillary issue stemming from the diminished importance of preparing teachers through the technical component of IT programs relates to the quality and relevance of the technical subject matter. If the adage "you teach as you were taught" has any credence, then many of the technical courses received through IT-centered programs are philosophically and contextually incompatible with current technology education programs suggested for secondary schools. Evans (1988) concurred, stating "a curriculum designed for prospective technologists and engineers seldom provides the content which prospective teachers need to teach" (p. 144). IA/TE centered technical courses which had pedagogical strategies and activities for future teachers of the subject may be of diminished importance or necessarily eliminated from IT-centered courses. For example, activities such as preparing and presenting a lesson to the class, or designing a project/activity for secondary schools might be a requirement in technical courses in which teaching the subject of technology was the prime focus. Hatch and Jones (1991) discussed this practice when they described the

IA/TE teacher preparation programs of the 1960s and 1970s. They stated that “to a large degree, teacher educators taught technical content and, not surprisingly, they frequently incorporated instruction about key aspect [sic] of teaching methodology within their technical courses” (p. 240). In this manner, valuable examples and experiences directly related to the profession of teaching are missing from technical courses designed for an IT curriculum, resulting in less qualified individuals being prepared or skilled in the art of teaching technical subjects.

Program Attractiveness

If the change of industrial arts into technology education is an evolutionary process (Clark, 1989; Kuskie, 1991; Wicklein, 1991), then the type of student preparing to be a technology educator may not be the same as before. Henak and Barella (1986) alluded to this qualifier when they stated that in order to develop the new and different competencies of technology education, “a new kind of teacher” is required (p. 167). Miller, R. (1988) commented on the ability of university technology education programs to attract students after observing trends for over a decade in his *Annual Survey of Industrial Arts Teacher Supply and Demand*. He stated:

It took industrial arts about 30 years to replace manual training and manual arts as a name in the public schools and in the mind of the public that supported the schools. The many areas such as woodworking, drafting or mechanical drawing, power and transportation ... were well-known and in most instances well-taught. (p. 14)

Miller further stated:

Needless to say, by now, everyone realizes that the changing of a name means there are some problems. The recruiting of young men and women into the teaching profession is difficult enough these days, but the changing of the name into something else makes it even harder to recruit when you have to tell the prospective professional that the name of the profession he/she is interested in has changed its name and direction. (p. 14)

The lack of detailed descriptors from the *Directory* listing specific course content prohibited an analysis of trends between those university programs continuing to provide traditional industrial arts courses with those that ceased. Further study needs to be conducted in this area.

Summary

The examination of the enrollment trends in industrial arts/technology teacher education programs from 1970 to 1990 indicated several broad trends: (a) university programs and student enrollment numbers continue to decline from the 1970 levels, (b) graduates with non-teaching degrees such as industrial technology has increased, and (c) universities with accompanying industrial

technology programs have witnessed a significantly greater percentage decrease in technology education enrollment than those universities that do not. The implications from these trends addressed issues such as program strength, compatibility, viability and attractiveness.

Considering the declining number of post secondary industrial arts/technology education graduates and the implications for the profession, it is imperative further discussion and studies be conducted, including the following:

- What are the projected future trends and program changes for universities? How many of the programs fear closure due to declining budgets or enrollment?
- How have faculty numbers and qualifications influenced the programs? Faculty research emphases and recruitment should be part of this discussion.
- To what extent are secondary teachers encouraging their students to become technology educators? In a similar manner, with the curriculum changes that have occurred, would those trained years ago as industrial arts teachers become technology educators, had they to do it over again?
- Are the existing secondary IA/TE teachers accepting the change to technology education? Studies by DeLucca and James (1991) and Rogers (1991) have begun to address this issue.
- Have the teacher preparation programs which maintained traditional industrial arts courses been more, or less successful in recruiting students?
- Are the expectations of new students in post-secondary technology education programs consistent with the philosophies taught? In other words, do new students know what they are getting into with the changing curriculum?

If the 20-year enrollment trend illustrated in Figure 1 continues, the demise of the profession will occur near the year 2005. It is therefore hoped the findings and implications presented serve as a catalyst for more discussion on the health and direction of post-secondary industrial arts/technology education programs. With the continued decline in technology educators being prepared and the changing emphasis in program options, the very survival of the profession is at stake.

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