Critical Problems Facing Technology Education: Perceptions of Indiana Teachers

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In 1993 Wicklein conducted a study to determine both the present and the future critical issues and problems facing the technology education (TE) profession. Wicklein (1993) stated, "If the classroom teachers, teacher educators and the supervisors/ administrators of technology education hope to direct the profession into a desirable future they must understand the issues and problems that will influence the success or failure of technology education" (pp. 55-56). At that time, following its name change from industrial arts in 1985, TE stood in its formative years. As with the implementation of any revised system, there were problems and concerns with the new TE discipline (Linnell, 1992).

The Wicklein study questioned 25 panelists from 15 states and the District of Columbia to ascertain the issues and problems facing TE. The panel consisted of seven secondary classroom teachers, nine teacher educators, and nine secondary and collegiate supervisors and administrators. Wicklein used a four-round Delphi process to determine and prioritize the critical issues and problems in TE.

The 15 future problems identified by Wicklein in the 1993 study are listed, in order of priority, in Table 1. In accordance with Wicklein's panelists' predictions, many of these problems are those that face TE educators today. However, in the Wicklein study, only seven of the panelists were classroom teachers. The present study investigates the severity of these problems in

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Table 1
Future problems in technology education in order of priority as identified by Wicklein

Rank #	Problem
1	Insufficient quantities of TE teachers and the elimination of teacher education programs in TE
2	Loss of TE identity; TE absorbed within other disciplines
3	Poor and/or inadequate public relations for TE
4	Non-unified curriculum for TE
5	Ignorance among general populace regarding technology and discipline of TE
6	Inadequate involvement of TE personnel in education reform issues
7	Elimination of TE programs
8	Reduction of enrollment in TE courses due to high school graduation requirements
9	Insufficient funding of TE programs
10	Inadequate business and industry support for TE
11	Inadequate research base for TE
12	Inadequate knowledge base for TE
13	Inadequate leadership and leadership training for TE
14	Inferior in-service training for TE
15	Inappropriate certification procedures for TE

schools today as perceived by current Indiana high school and middle school TE teachers.

Research Questions

This study sought to answer the following two research questions:

1. What is the current level of severity of the 15 future problems identified by Wicklein (1993) as perceived by Indiana TE teachers?
2. Do Indiana TE teachers' perceptions of the 15 future problems (Wicklein, 1993) differ based on the Indiana teachers' demographic characteristics?

Design of the Study

The current study used a blended research methodology that combined both quantitative and qualitative data analyses. Brewer and Hunter (1989) reported, "The multi-method approach is a strategy for overcoming each method's weaknesses and limitations by deliberately combining different types of methods within the same investigations" (p. 11). The quantitative and qualitative methodologies used in the current study enabled the researchers to investigate various dimensions of the study subjects' responses.

The quantitative data for this study were collected using a descriptive survey. According to McMillan and Schumacher (1997), "Surveys are used frequently in educational research to describe attitudes, beliefs, opinions, and other types of information" (p. 38). Since the current study sought to determine if the perceived severity of the future problems in TE cited in Wicklein's (1993) report is related to demographic variables, this methodology was deemed appropriate. The researchers obtained the qualitative data by allowing the respondents an opportunity to provide free-responses and to list current problems not specifically identified on the survey instrument.

Population and Sample

The researchers acquired a list of 1,043 TE teachers from the Indiana Department of Education. A simple random sample of 747 of these teachers served as the sample for this study. Each teacher in the sample was mailed a cover letter, the survey instrument, and a postage-paid return envelope. A total of 267 surveys were returned, which represented a return rate of 35.7%.

Instrument

According to Gall and Borg (1996), "The purpose of a survey is to use questionnaires or interviews to collect data from participants in a sample about their characteristics, experiences, and opinions in order to generalize the findings to a population that the sample is intended to represent" (p. 289). In the present study, the first section of the survey instrument collected each participant's demographic data, which included gender, highest

degree earned, grade level taught, number of years of teaching experience, school community type, and his or her age.

In the second section of the survey, the TE teachers were provided a list of the 15 future problems identified by Wicklein (1993) and asked to rate each problem's severity using a four-point Likert-type scale. The Likert-type scale was based upon a similar instrument used by VanderJagt, Shen, and Hsieh (2001) in a study that examined elementary and secondary public school principals' perceptions of school problems. The four-point Likert-type scale values were 1 = not a problem, 2 = minor problem, 3 = moderate problem, and 4 = serious problem. To obtain qualitative data, the instrument provided an opportunity for the teachers to submit free-response comments concerning the TE field.

Data Analysis

Of the 267 survey respondents, 258 were male (96.6%) and nine were female (3.4%). The majority of the TE teachers who responded to the survey had earned a master's degree (76.8%), were over 40 years of age (77.9%), taught in a high school setting (55.4%), and taught in a rural or town environment (66.3%). Table 2 summarizes the respondents' demographic data.

Research question one sought to determine the TE teachers' overall perceptions of the level of severity of each of the 15 future problems identified by Wicklein (1993). To address this question, means and standard deviations of the teachers' ratings of the severity of each problem listed in the survey were computed. Since the Likert-type scale values ranged from 1 (not a problem) to 4 (a serious problem), problems perceived as most serious are those with mean scores closest to 4 (see Table 3).

Overall, of the 15 problems, the TE teachers rated the impact of high school graduation requirements on the enrollment in TE courses as the most serious problem (M = 3.12, SD = 0.98). The problem of the general public's lack of understanding of TE received the second highest mean score (M = 3.02, SD = 0.86). Although the problem of insufficient funding for TE programs received the third highest mean score (M = 3.00, SD = 1.00), its mean score value of 3.00 indicated that respondents saw it overall as a "moderate," rather a "serious," problem for the TE field.

Table 2
Demographic descriptions of respondents

	TE teachers $n = 267$	
Highest degree earned:		
Bachelor's	57	(21.3%)
Master's	205	(76.8%)
Years of age:		
Less than 30	23	(8.6%)
31-40	28	(10.5%)
41-50	77	(28.8%)
51-60	115	(43.1%)
Over 60	16	(6.0%)
Years teaching experience:		
0-4	21	(7.9%)
5-10	26	(9.7%)
11-15	26	(9.7%)
16-20	25	(9.4%)
21-25	32	(12.0%)
26-30	61	(22.9%)
31-35	75	(28.1%)
School type:		
High school 9-12	148	(55.4%)
Middle school 6-9	71	(26.6%)
Middle/high school 7-12	45	(16.9%)
Community type:		
Rural	113	(42.3%)
Town	64	(24.0%)
Suburban	50	(18.8%)
Urban	40	(15.0%)

* Some responses contained missing data.

Research question two focused on the differences among the TE teachers' perceptions of the severity of Wicklein's cited problems based on the teachers' demographic characteristics. To answer this question, the data were analyzed using one-way analyses of variance (ANOVAs) to compare item response means among demographic groups. For each ANOVA, the categorical

variable was the level of respondents' demographic characteristic, and the dependent variable was the respondents' mean score on each survey item. All significant ANOVAs were followed by a Tukey's post-hoc test to determine which demographic group(s) differed significantly from the others. All ANOVAs and post-hoc tests used the .05 level of significance. For demographic items with only two categories, independent sample *t*-tests were used to

Table 3
Respondents' ratings of severity of Wicklein's future problems in technology education

Wicklein's Problem #	*M*	*SD*	Not a problem	Minor Problem	Moderate problem	Serious problem
8	3.12	.98	21 (8.0%)	48 (18.4%)	70 (26.8%)	122 (46.7%)
5	3.02	.86	15 (5.6%)	53 (19.9%)	111 (41.7%)	87 (32.7%)
9	3.00	1.00	26 (9.9%)	53 (20.2%)	78 (29.7%)	106 (40.3%)
7	2.93	.98	28 (10.7%)	51 (19.5%)	92 (35.2%)	90 (34.5%)
2	2.86	1.01	35 (13.3%)	52 (19.8%)	91 (34.6%)	85 (32.3%)
3	2.78	1.00	36 (13.5%)	62 (23.3%)	92 (34.6%)	76 (28.6%)
1	2.71	1.05	46 (17.5%)	57 (21.7%)	86 (32.7%)	74 (28.1%)
6	2.70	.98	35 (13.6%)	71 (27.6%)	88 (34.2%)	63 (24.5%)
14	2.66	.97	38 (14.6%)	69 (26.5%)	96 (36.9%)	57 (21.9%)
10	2.52	1.01	49 (18.6%)	82 (31.1%)	80 (30.3%)	53 (20.1%)
13	2.47	.98	48 (18.8%)	82 (32.2%)	81 (31.8%)	44 (17.3%)
4	2.43	1.09	70 (26.3%)	68 (25.6%)	71 (26.7%)	57 (21.4%)
11	2.26	1.03	77 (28.9%)	82 (30.8%)	68 (25.6%)	39 (14.7%)
12	2.18	.94	67 (26.8%)	95 (38.0%)	63 (25.2%)	25 (10.0%)
15	2.08	1.01	92 (36.5%)	77 (30.6%)	55 (21.8%)	28 (11.1%)

assess whether the means of the two groups differed statistically from each other. All *t*-tests used the .05 level of significance. The separate variance *t*-test and the Welch test were used to control type-one error. When only two groups were being compared, the separate variance *t*-test was selected when the Levene's test reported that unequal group variances were present. If more than two groups were being compared, the Welch test was selected as a substitute for the *F*-test when conditions of heterogeneous variance were detected by Levene's test. The Welch test is considered robust with regard to violations of unequal variances (Welch, 1938). The type-one error rate was maintained at the .05 level for each statistical test.

Comparisons by Highest Degree Earned

Table 4 contrasts the mean ratings for the 15 cited problems calculated for the group of teachers whose highest degree was a bachelor's degree compared to the mean ratings calculated for teachers with masters' degrees. In comparing the two groups, the greatest difference in the means occurred for the survey item that concerned the problem of a non-unified TE curriculum. The independent samples *t*-test revealed that TE teachers with masters' degrees perceived the problem of a non-unified TE curriculum as more severe (M = 2.56) than did the teachers with bachelors' degrees (M = 2.04) (t = 3.45, df = 97, p = .001). Teachers with masters' degrees also rated the elimination of TE programs as a more severe problem (M = 3.00) than did the teachers whose highest degree was a bachelor's degree (M = 2.69) (t = 2.12, df = 254, p = .035). The impact on enrollment in TE courses due to new graduation requirements was also ranked as a more severe problem by teachers with masters' degrees (M = 3.18) than by those with bachelors' degrees (M = 2.88) (t = 2.07, df = 254, p = .040).

Comparisons by Grade Level Taught

The survey data were also analyzed to determine if the respondents' perceptions of the severity of the 15 future problems identified by Wicklein (1993) differed depending on the grade levels that the teachers taught. Respondents were grouped into three categories: high school teachers (grades 9-12); middle school

Table 4
Comparisons of responses by highest degree earned

Wicklein's Problem #	Bachelor's			Master's		
	M	*SD*	*n*	*M*	*SD*	*n*
1	2.72	1.05	57	2.72	1.06	201
2	2.69	0.98	55	2.91	1.02	203
3	2.63	1.00	56	2.82	1.01	205
4	2.04	0.97	56	2.56	1.10	205
5	2.91	0.85	57	3.05	0.86	204
6	2.66	0.96	53	2.72	1.00	199
7	2.69	0.96	55	3.00	0.98	201
8	2.88	0.97	56	3.18	0.98	200
9	3.00	0.98	55	3.01	1.02	203
10	2.52	0.91	56	2.54	1.04	203
11	2.18	0.95	57	2.31	1.05	204
12	2.00	0.87	54	2.24	0.96	191
13	2.33	0.84	55	2.50	1.03	195
14	2.64	0.96	56	2.66	0.99	199
15	2.21	1.08	53	2.03	0.99	194

Table 5
Highest degree earned independent samples test

Wicklein's Problem #	Problem	*t*-test for Equality of Means				
		t	*df*	Sig. 2-tailed	*MD*	*SED*
4	Non-unified curriculum for TE	3.45	97	0.001	0.52	0.16
7	Elimination of TE programs	2.12	254	0.035	0.31	0.15
8	Reduction of enrollment in TE courses due to high school graduation requirements	2.07	254	0.040	0.31	0.15

teachers (grades 6-9); and teachers who taught grades 7-12, spanning both high school and middle school. The results of the findings are tabulated in Table 6. Table 7 shows the significant findings of the one-way ANOVAs.

Table 6
Comparison of responses by grade level taught

Wicklein's Problem #	High School 9-12			Middle School 6-9			Grades 7-12		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
1	146	2.78	1.00	70	2.60	1.16	44	2.66	1.06
2	147	3.00	0.93	68	2.66	1.14	45	2.67	1.04
3	148	2.93	0.96	70	2.60	1.04	45	2.58	1.03
4	148	2.62	1.06	70	2.20	1.11	45	2.13	1.06
5	147	3.11	0.83	71	2.86	0.98	45	2.98	0.78
6	142	2.80	0.96	68	2.54	1.07	44	2.59	0.92
7	146	2.99	0.94	67	2.81	1.05	45	2.91	1.04
8	148	3.08	1.02	66	3.17	0.92	44	3.14	0.95
9	147	3.01	1.02	70	2.87	1.01	43	3.23	0.87
10	147	2.49	1.02	69	2.62	1.07	45	2.44	0.89
11	148	2.33	1.01	71	2.24	1.06	44	2.07	1.04
12	139	2.28	0.95	66	2.00	0.91	43	2.14	0.97
13	142	2.65	0.95	67	2.28	1.03	43	2.14	0.91
14	145	2.81	0.94	68	2.54	0.98	44	2.34	0.99
15	137	2.26	1.02	69	1.86	0.91	43	1.81	1.01

Teachers in all three types of schools rated the impact of new graduation requirements as first or second in terms of severity. However, the means for the problem pertaining to the lack of unity in the TE curriculum showed statistically significant differences among the three categories of teachers. ($F_{(2,260)} = 5.69$, $p = .004$). Post hoc comparisons (see Table 8) revealed that TE teachers who taught in high schools perceived the non-unified curriculum as a more severe problem ($M = 2.62$) than did those who taught in middle schools ($M = 2.20$). The high school teachers also rated the problem of a lack of a unified curriculum as more severe than did the teachers who taught grades 7-12 ($M = 2.13$).

When grouped by grade level taught, differences also appeared in the teachers perceptions of the problem of inadequate leadership and leadership training for TE ($F_{(2,249)} = 6.15$, $p = .002$). Post hoc comparisons found that TE teachers who taught in high schools perceived the problem of leadership and leadership

Table 7
Grade level taught ANOVA

Wicklein's Problem #		*SS*	*df*	*F*	Sig.
2	Between Groups	7.226	2	3.554	0.030
	Within Groups	261.221	257		
	Total	268.446	259		
3	Between Groups	7.544	2	3.815	0.023
	Within Groups	257.102	260		
	Total	264.646	262		
4	Between Groups	13.093	2	5.689	0.004
	Within Groups	299.211	260		
	Total	312.304	262		
13	Between Groups	11.509	2	6.145	0.002
	Within Groups	233.169	249		
	Total	244.679	251		
14	Between Groups	8.822	2	4.773	0.009
	Within Groups	234.726	254		
	Total	243.549	256		
15	Between Groups	10.719	2	5.468	0.005
	Within Groups	241.121	246		
	Total	251.839	248		

training as more severe (M = 2.65) than either middle school teachers (M = 2.28) or teachers who taught grades 7-12 (M = 2.14). Another area in which differences between the three groups arose was in their perceptions of the severity of the problem of inappropriate certification procedures for TE. ($F_{(2,246)}$ = 5.47, p = .005). Analyses by post hoc comparisons showed that high school TE teachers perceived inappropriate certification procedures as a more severe problem (M = 2.26) than did teachers who taught in middle school (M = 1.86) and also more severe than did those teachers who taught in grades 7-12 (M = 1.81).

Table 8
Grade level taught multiple comparisons Tukey HSD

(Wicklein's Problem #) Dependent Variable	(I) Grade Level Taught	(J) Grade Level Taught	*MD* (I-J)	Std. Error	Sig.	95% C.I. Lower	95% C.I. Upper
4	9-12	6-12	0.42	0.15	0.020	0.05	0.79
	7-12	9-12	-0.49	0.18	0.022	-0.92	-0.06
13	9-12	6-12	0.36	0.14	0.031	0.03	0.70
		7-12	0.51	0.17	0.008	0.11	0.91
14	9-12	7-12	0.47	0.17	0.013	0.08	0.86
	7-12	9-12	-0.47	0.17	0.013	-0.86	-0.08
15	9-12	6-12	0.40	0.15	0.018	0.06	0.75
		7-12	0.44	0.17	0.030	0.03	0.85

Comparisons by Years of Teaching Experience

A respondent's number of years of teaching experience also appeared to affect his or her perceptions of the severity of several of the 15 cited problems. Table 9 shows the teachers' ratings when grouped by the teachers' years of teaching experience. The significant findings of the one-way ANOVAs are summarized in Table 10.

When grouped by number of years of teaching experience, the respondents showed differences in their perceptions of the severity of the problem concerning the lack of unity in the TE curriculum. ($F_{(6,258)} = 3.50$, $p = .002$). Post hoc comparisons (see Table 11) verified that TE teachers who had taught in the range of 16-20 years perceived this problem as more severe ($M = 2.88$) than did those who had taught 0-4 years ($M = 1.90$). Those who had taught 31-35 years also rated the problem of a non-unified curriculum statistically significantly higher in terms of severity ($M = 2.72$), than teachers who had taught 0-4 years ($M = 1.90$).

The severity of the problem of an inadequate research base for TE also differed in the teachers' perceptions when compared by years of teaching experience ($F_{(6,258)} = 2.63$, $p = .017$). When grouped by number of years of teaching experience, post hoc comparisons found that TE teachers who had taught in the

range of 31-35 years perceived the lack of an adequate research base as a more severe problem (M = 2.51) than did those who had taught 11- 15 years (M = 1.81).

Table 9
Comparison of responses by years of teaching experience

	0-4 Years			5-10 Years		
Wicklein's Problem #	*M*	*SD*	*n*	*M*	*SD*	*n*
1	2.86	1.06	21	2.54	0.86	26
2	2.65	0.99	20	2.85	1.05	26
3	2.52	0.87	21	2.62	1.06	26
4	1.90	0.77	21	2.00	0.94	26
5	2.90	0.70	21	3.00	0.94	26
6	2.52	0.98	21	2.80	0.91	25
7	2.71	1.10	21	2.65	0.89	26
8	2.76	0.83	21	3.00	1.15	25
9	2.85	1.04	20	2.88	1.11	26
10	2.33	1.02	21	2.23	0.95	26
11	2.29	0.90	21	1.81	0.98	26
12	1.95	0.92	21	2.08	0.91	25
13	2.29	0.96	21	2.31	0.79	26
14	2.67	1.11	21	2.68	0.95	25
15	2.10	1.09	21	2.16	1.11	25

	11-15 Years			16-20 Years		
1	2.85	1.22	26	3.04	1.02	25
2	2.71	1.08	24	2.46	1.02	24
3	2.68	0.99	25	2.64	0.99	25
4	2.20	1.15	25	2.88	1.05	25
5	2.92	0.93	26	2.96	0.89	25
6	2.87	0.87	23	2.64	1.08	25
7	2.91	0.95	23	2.68	1.03	25
8	2.96	1.06	25	3.20	1.00	25
9	3.16	1.03	25	2.71	0.86	24
10	2.20	1.00	25	2.36	1.11	25
11	1.81	0.85	26	2.44	1.00	25
12	1.86	0.85	21	2.29	0.95	24
13	2.52	0.95	23	2.54	1.06	24
14	2.71	0.91	24	2.60	1.19	25
15	2.05	0.94	20	2.08	0.97	24

Table 9 continued

	21-25 Years			26-30 Years			31-35 Years		
Wicklein's Problem #	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
1	2.86	1.03	29	2.65	1.01	60	2.57	1.13	75
2	2.97	0.86	32	3.00	0.95	61	2.92	1.10	75
3	2.88	0.94	32	2.84	0.97	61	2.91	1.10	75
4	2.28	1.17	32	2.43	1.12	61	2.72	1.07	75
5	3.09	0.78	32	2.92	0.79	60	3.13	0.96	75
6	2.60	1.00	30	2.61	0.98	59	2.77	1.03	73
7	2.93	0.94	30	3.17	0.94	60	2.99	1.01	75
8	3.09	0.96	32	3.19	0.91	58	3.24	0.99	74
9	3.10	0.91	31	3.20	0.96	61	2.92	1.05	75
10	2.59	0.91	32	2.73	1.06	60	2.62	0.99	74
11	2.19	1.06	32	2.30	0.94	60	2.51	1.14	75
12	2.17	0.97	29	2.19	0.84	59	2.36	1.05	70
13	2.17	1.07	29	2.46	0.95	57	2.69	1.03	74
14	2.52	1.03	31	2.66	0.88	59	2.73	0.98	74
15	1.86	0.99	29	2.02	0.98	58	2.16	1.05	74

Table 10

Years of teaching experience ANOVA

Wicklein's Problem #		*SS*	*df*	*F*	Sig.
4	Between Groups	24.00	6	3.50	0.002
	Within Groups	294.96	258		
	Total	318.96	264		
11	Between Groups	16.29	6	2.63	0.017
	Within Groups	266.74	258		
	Total	283.03	264		

Table 11
Years of teaching experience multiple comparisons Tukey HSD

(Wicklein's Problem #) Dependent Variable	(I) Number of Years Teaching	(J) Number of Years Teaching	*MD* (I-J)	*SE*	Sig.	95% Confidence Interval	
						Lower	Upper
4	0-4	31-35	-0.82	0.26	0.036	-1.60	-0.03
	16-20	0-4	0.98	0.32	0.037	0.03	1.92
11		31-35	-0.70	0.23	0.044	-1.39	-0.01
	11-15	31-35	-0.70	0.23	0.044	-1.39	-0.01

Comparisons by Instructor's Age

Respondents were also grouped according to their ages to determine if the age of the instructor affected his or her perception of the severity of the 15 cited problems. Table 12 shows a summary of the respondents' ratings when analyzed by the instructors' age groups. The significant findings of the one-way ANOVAs are summarized in Table 13. The data showed that the instructor's age had a bearing on his or her perception of the severity of the problem concerning the reduction of enrollment in TE courses due to high school graduation requirements ($F_{(4,248)}$ = 2.86, p = .024). No pair wise differences were found in the post hoc analysis.

However, post hoc comparisons, summarized in Table 14, confirmed that an instructor's age had a bearing on his or her perception of the severity of the problem of a lack of an adequate research base for TE ($F_{(4,253)}$ = 3.78, p = .005). TE teachers who were 61 years old or older perceived the inadequate research base for TE as a more severe problem (M = 3.06) than did either the group of teachers aged 31-40 years (M = 1.93) or the group aged 41-50 years (M = 2.12).

The instructor's age also related to his or her perception of the severity of the problem of inadequate leadership and leadership training for TE. ($F_{(4,243)}$ = 2.92, p = .022). Again, the older TE teachers (aged 61 or older) perceived the lack of leadership and leadership training as a more severe problem for TE (M = 3.00) than did TE teachers in the 41-50 year age bracket. (M = 2.22).

Table 12
Comparisons of responses by instructor's age

	21-30			31-40			41-50		
Wicklein's Problem #	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
1	3.04	0.82	23	2.82	1.02	28	2.72	1.04	74
2	2.95	0.90	22	2.70	1.07	27	2.71	0.99	76
3	2.48	0.95	23	2.71	1.01	28	2.75	0.92	77
4	2.09	1.00	23	2.32	1.09	28	2.34	1.12	77
5	2.96	0.82	23	3.04	0.88	28	2.94	0.83	77
6	2.65	0.98	23	2.74	0.90	27	2.60	0.97	72
7	2.74	0.96	23	2.81	1.00	27	2.76	1.02	75
8	2.91	0.85	23	3.26	1.02	27	2.88	1.05	77
9	2.87	1.01	23	2.82	1.09	28	2.88	0.98	74
10	2.17	1.03	23	2.29	0.98	28	2.36	1.00	77
11	2.17	0.94	23	1.93	0.98	28	2.12	0.97	77
12	2.00	1.00	23	2.20	0.91	25	2.11	0.87	71
13	2.35	0.93	23	2.48	0.89	27	2.22	1.01	72
14	2.65	0.93	23	2.78	1.09	27	2.51	1.01	75
15	2.05	1.09	22	2.15	1.08	26	1.91	0.88	70

Comparisons by Community Type

The type of community—urban, suburban, town, or rural—in which a teacher taught was also examined to see if community setting related to a TE teacher's perceptions of the severity of Wicklein's future problems. Urban schools were defined as those located in a city or densely populated area. Suburban schools were considered as those located in residential districts on the outskirts of cities. A school located in an urban area with a fixed boundary smaller than a city was defined as a town school. A rural school was defined as a school located in a sparsely settled or agricultural area. The rankings for the severity of the problems as calculated when teachers were grouped by their school community types is noted in Table 15. The significant findings of the one-way ANOVAs are summarized in Table 16.

Table 12 continued

	51-60			61+		
Wicklein's Problem #	*M*	*SD*	*n*	*M*	*SD*	*n*
1	2.63	1.12	114	2.69	1.08	16
2	2.97	1.05	114	3.06	1.00	16
3	2.89	1.07	114	3.00	1.03	16
4	2.51	1.12	114	3.00	0.73	16
5	3.03	0.94	114	3.44	0.63	16
6	2.69	1.06	111	3.19	0.66	16
7	3.13	0.96	112	3.06	0.77	16
8	3.27	0.92	110	3.50	0.89	16
9	3.11	1.03	114	3.31	0.87	16
10	2.72	1.03	112	2.81	0.83	16
11	2.33	1.09	114	3.06	0.85	16
12	2.17	1.00	107	2.75	0.86	16
13	2.60	0.98	110	3.00	0.97	16
14	2.69	0.95	112	3.13	0.83	15
15	2.20	1.08	111	1.93	0.80	15

Table 13

Instructor's Age ANOVA

Wicklein's Problem #		*SS*	*df*	*F*	Sig.
8	Between Groups	10.65	4.00	2.86	0.024
	Within Groups	230.78	248.00		
	Total	241.43	252.00		
11	Between Groups	15.74	4.00	3.78	0.005
	Within Groups	263.38	253.00		
	Total	279.12	257.00		
13	Between Groups	11.10	4.00	2.92	0.022
	Within Groups	230.80	243.00		
	Total	241.90	247.00		

Table 14
Instructor's Age Multiple Comparisons Tukey HSD

(Wicklein's Problem #) Dependent Variable	(I) Age	(J) Age	*MD* (I-J)	*SE*	Sig.	95% C.I. Lower	95% C.I. Upper
11	31-40	61+	-1.13	0.32	0.004	-2.01	-0.26
	41-50	61+	-0.95	0.28	0.008	-1.72	-0.18
13	41-50	61+	-0.78	0.27	0.034	-1.52	-0.04

The analysis of the data revealed differences occurred in the teachers' perceptions of the severity of the problem of poor and/or inadequate public relations for TE depending on the type of community in which their school was located. ($F_{(3,262)} = 5.41$, $p = .001$). TE teachers who taught in schools located in towns perceived poor and/or inadequate public relations for TE as a more severe problem ($M = 3.13$) than did those who taught in rural schools ($M = 2.56$). Post hoc comparisons summarized in Table 17 confirmed the statistical significance of these differences.

The teachers' perception of the severity of the problem of a non-unified TE curriculum also differed depending on the type of school community in which the teacher taught. ($F_{(3,262)} = 3.05$, $p = .029$). Post hoc comparisons revealed that TE teachers who taught in urban schools felt the lack of a unified curriculum was a more severe problem ($M = 2.90$) than did those who taught in rural schools ($M = 2.32$).

The problem of inappropriate certification procedures for TE also showed differences in rankings when respondents were grouped by community type. ($F_{(3,248)} = 2.80$, $p = .041$). Post hoc comparisons showed that TE teachers who taught in urban schools perceived inappropriate certification procedures as a more severe problem ($M = 2.33$) than those who taught in suburban schools ($M = 1.74$).

While all four groups rated insufficient funding for TE programs as a minor to moderate problem, the severity ratings for this problem also showed differences related to community type ($F_{(3,259)} = 5.53$, $p = .001$). Post hoc comparisons found that TE teachers who taught in rural schools ranked the problem of

Table 15
Comparison of responses by community type

Wicklein's Problem #	Rural			Town		
	M	*SD*	*n*	*M*	*SD*	*n*
1	2.58	1.05	112	2.94	1.01	63
2	2.79	0.96	112	2.84	1.05	63
3	2.56	0.97	113	3.13	0.88	64
4	2.32	1.05	113	2.42	1.18	64
5	2.95	0.83	112	3.09	0.79	64
6	2.69	0.88	109	2.68	0.98	60
7	2.95	0.93	111	2.98	1.00	64
8	3.15	0.96	111	3.09	1.05	64
9	3.18	1.00	112	2.73	0.94	63
10	2.54	0.89	112	2.38	1.15	64
11	2.18	0.98	112	2.42	1.14	64
12	2.07	0.86	106	2.28	1.06	60
13	2.37	0.95	107	2.65	0.97	60
14	2.60	0.99	112	2.75	0.93	63
15	2.07	1.03	106	2.18	0.98	60

insufficient funding as a more severe problem ($M = 3.18$), than either those who taught in town schools ($M = 2.73$) or those who taught in suburban schools ($M = 2.71$) At the same time, teachers who taught in schools located in urban areas perceived the problem of funding as more severe ($M = 3.30$) than those who taught in towns (M= 2.73) or those who taught in suburban areas (M = 2.71).

Wicklein's Problem #	Suburban			Urban		
	M	*SD*	*n*	*M*	*SD*	*n*
1	2.67	1.09	49	2.79	1.08	39
2	2.86	1.12	49	3.08	1.01	39
3	2.67	1.05	49	3.00	1.09	40
4	2.33	1.01	49	2.90	1.10	40
5	2.92	0.99	50	3.20	0.94	40
6	2.56	1.07	48	2.90	1.17	40
7	2.74	1.05	47	3.03	1.04	39
8	3.04	0.93	47	3.18	1.00	39
9	2.71	1.05	48	3.30	0.88	40
10	2.52	0.99	48	2.70	1.14	40
11	2.06	0.96	50	2.48	1.06	40
12	2.15	0.84	46	2.39	1.05	38
13	2.27	0.95	49	2.74	1.09	39
14	2.57	0.95	47	2.82	1.06	38
15	1.74	0.79	47	2.33	1.18	39

Table 15 continued

Qualitative Survey Responses

The survey respondents were also given the opportunity to provide free responses or to list current problems in the TE field that were not identified on the survey instrument. Many of the TE teachers' qualitative responses were consistent with Wicklein's (1993) list of future problem. Table 18 lists the topics that were identified by many respondents and that corresponded to Wicklein's themes.

The TE teachers indicated through their qualitative responses that they feel the public does not understand the TE discipline. In the view of the teachers, the public still perceives TE as "shop" and technology as "computers." The teachers also reported that they believe increased high school graduation requirements are affecting the TE field adversely. In addition, they feel that they, the TE teachers, do not have a voice in educational reform efforts.

Table 16

Community Type ANOVA

Wicklein's Problem #		*SS*	*df*	*F*	Sig.
3	Between Groups	15.70	3	5.41	0.001
	Within Groups	253.65	262		
	Total	269.35	265		
4	Between Groups	10.77	3	3.05	0.029
	Within Groups	308.52	262		
	Total	319.28	265		
9	Between Groups	15.84	3	5.53	0.001
	Within Groups	247.16	259		
	Total	263.00	262		
13	Between Groups	7.90	3	2.76	0.043
	Within Groups	239.68	251		
	Total	247.58	254		
15	Between Groups	8.44	3	2.80	0.041
	Within Groups	249.12	248		
	Total	257.57	251		

Table 17
Community Type Multiple Comparisons Tukey HSD

(Wicklein's Problem #) Dependent Variable	(I) Community Type	(J) Community Type	MD (I-J)	SE	Sig.	95% C.I. Lower	95% C.I. Upper
3	Rural	Town	-0.57	0.15	0.002	-0.97	-0.17
		Town	-0.57	0.15	0.002	-0.97	-0.17
4	Rural	Urban	-0.58	0.20	0.020	-1.10	-0.07
9	Rural	Town	0.45	0.15	0.020	0.05	0.85
		Suburban	0.47	0.17	0.029	0.03	0.91
	Town	Urban	-0.57	0.20	0.022	-1.08	-0.06
15	Suburban	Urban	-0.59	0.21	0.026	-1.13	-0.05
	Suburban	Urban	-0.59	0.22	0.036	-1.15	-0.03

Table 18
Qualitative survey responses grouped by Wicklein's themes

#	Problem	Frequency	%
1	Quantity of TE teachers: (n = 87)		
	Programs closing due to lack of teachers	11	12.6
	Hard to find teachers	11	12.6
2	TE identity: (n = 71)		
	Technology implies computers	14	19.7
	Not recognized by students, parents, & administrators	11	15.5
	People do not understand TE	10	14.1
3	Public relations: (n = 67)		
	Name causes confusion	8	11.9
4	TE curriculum (n = 82)		
	TE Curriculum is good	20	24.4
	TE curriculum is weak	19	23.2
	Curriculum is not being implemented consistently	13	15.9
	Lack of hands-on skills	9	11.0
5	General populace understanding: (n = 63)		
	Believes TE is "shop"	26	41.3
	Does not understand TE	16	25.4
6	Involvement in educational reform: (n = 60)		
	TE teachers do not have a voice	13	21.7
	No involvement by TE personnel	9	15.0
7	Health of TE programs: (n = 74)		
	Health is good	15	20.3
	Funding is a problem	11	14.9
8	Graduation requirements: (n = 78)		
	No room in schedule for electives	23	29.5
	Graduation requirements hurting TE	11	14.1
	TE should be required fro graduation	11	14.1
9	Funding: (n = 72)		
	Funding is not good	32	44.4
	Funding is good	17	23.6
10	Business and industry support: (n = 68)		
	Support is good	26	38.2
	Limited support	22	32.4

In two areas the qualitative responses to the survey revealed disparities among the teachers' views concerning current issues in the TE field. One of these areas regarded funding. While 44.4% of the respondents expressed the opinion that funding was "not good," another 23.6% indicated funding was "good." Business and industry support was another area in which respondents had differing views. Some 38.2% of the teachers stated their opinion that business and industry support was "good." On the other hand, 32.4% of teachers categorized business and industry support as "limited."

Discussion

Graduation Requirements

Overall, the TE teachers who responded to the current survey reported the problem of the impact of high school graduation requirements on TE courses as the most serious problem of the 15 future problems identified by Wicklein in his 1993 study. There were however, differences in the perceived severity of this problem when demographic groups were compared. Older teachers and/or those who had taught longer tended to view the impact of high school graduation requirements on TE as a more severe problem than did younger teachers and those who were new to the teaching field. Likewise, teachers who had earned a master's degree felt it was of greater concern to the TE field than did teachers whose highest degree was a bachelor's degree. However, it is interesting to note that middle school TE teachers rated the severity of this problem greater than did high school TE teachers.

Again when qualitative comments in the free-response section of the survey were tabulated, the most frequently cited problem was "graduation requirements harming TE" (11.9%). Some respondents stated that "students do not have room in their schedule for electives," or "TE needs to be required for graduation."

According to Stadt (1989), in many states English, mathematics, or science are allowed to gain control of the Carnegie units required for graduation, which reduces the opportunities for students to enroll in elective coursework.

Although Wicklein's (1993) study identified the impact of graduation requirements as a concern, nevertheless the problem at that time ranked eighth in order of priority. From both the qualitative and quantitative findings of the present study, it appears that graduation requirements and their effect upon TE enrollment are currently of primary concern to Indiana TE teachers.

Understanding of Technology

The Indiana teachers who participated in the current survey rated the problem of ignorance among the general populace regarding technology and the discipline of TE as the second most severe problem faced by the TE teachers. Qualitative feedback in the free-response section of the survey confirmed this concern. Free-responses included comments such as "technology implies computers" and the "name causes confusion." A Gallup poll conducted for the International Technology Education Association (ITEA) also revealed that the American public lacks a clear understanding of TE and technological literacy (Dugger and Rose, 2002). These conclusions were reinforced by additional data obtained by a follow up study by Dugger, Gallup, Rose and Starkweather (2004).

In Wicklein's (1993) study, the problem of the general public's lack of understanding of TE ranked fifth in order of priority. The current findings indicate that Indiana TE teachers view this problem as more serious than did the panelists in Wicklein's study. However, since the date of Wickleins's study, the proliferation of technological tools and gadgets has increased dramatically. According to Petrina (2003), after the microcomputer innovations of the late 1970s and 1980s, a digital technology revolution occurred in the 1990s. It is likely that this digital revolution has created greater confusion about technology since the time of the Wicklein study, and the Indiana teachers' who took part in the current study may have perceived this confusion among the general public and reflected it in their survey responses.

The mushrooming of technology in the last decade may also partly explain the frequency of qualitative response that the "focus of TE needs to change." Another explanation for this

response may be that some TE teachers see a need to incorporate more engineering into TE. The perception of a need for change in the discipline may also be linked to and partially based on the public's misunderstanding of TE and what it incorporates.

The fact that the majority (62.9%) of the teachers who responded to the survey had over 20 years of teaching experience and many (43.1%) were between the ages of 51 to 60, may provide another explanation for the statement that the focus of TE needs to change. Older teachers and those who had been in the field for 20 years or more were most likely trained as industrial arts teachers. These teachers may dislike the way the field has evolved into TE. They may not associate the same type of value with TE as they did with industrial arts. Their desire may be to see TE return to its industrial arts format.

Funding

Survey respondents ranked lack of sufficient funding as the third most serious problem for TE. These findings are substantiated by the literature which suggests there are problems with funding. Oaks (1991) surveyed TE supervisors in the 50 states to determine what state resources are available to assist in the transition to TE. Lack of funding was reported to be the most significant barrier to having an excellent TE program. According to Bussey, Dormody, and VanLeeuwen (2000), increased funding, development of financial incentives, and increased state-level support were listed as three of the five most frequently cited suggestions for strengthening TE.

Based on the findings of this study and other studies, the TE profession must address several critical issues in order to sustain itself as a discipline and assist American youth in developing the knowledge and skills required in the twenty-first century. Technology education must establish among the general public an understanding of its content and its relevance to society. This may require a name change and a redirection to a curricular content that is more widely understood and valued by the general public. In addition, technology education must establish itself as an essential component for high school graduation. These actions will require both bold leadership by the

discipline's professional associations as well as flexibility and innovation by its teachers.

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