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School improvement initiatives have been the focus of recent political agendas, professional conferences, and publications (Harris, 2005). A recent educational change initiative in Indiana has been Project Lead The Way (PLTW). According to Rogers (2005) the state's technology education teachers have embraced PLTW and its infusion into the high school curriculum. The PLTW curriculum is described as "a four-year sequence of courses which, when combined with college preparatory mathematics and science courses in high school, introduces students to the scope, rigor, and discipline of engineering and engineering technology prior to entering college" (PLTW, 2005). Although this research noted that the Indiana teachers had accepted the PLTW curriculum, there was no discussion as to the attitude or perception of the high school principals related to this new curriculum.

The implementation and acceptance of educational change efforts is greatly influence by the school's building administrator (Praisner, 2003). As the educational leader, the principal can establish an environment that is acceptable to change, or one that impedes the change initiative. According to Evans and Teddie (1993) many research studies point to the building principal as the most critical leadership determinant in educational change. Evans and Teddie noted that the building principals are the change facilitators.

The role of the high school principal has expanded to include the responsibilities of designing, managing, and implementing curricular change efforts (Praisner, 2003). According to Hipp and Huffman (2000), the principal's leadership is seen as the key factor to imple-

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menting any school change. As the high school leader, the principal has the major influence on "resource allocation, staffing, structures, information flow, and operating processes that determine what shall and shall not be done" in each high school (Nanus, 1992, p. 142). Nwanne (1996) concurred, indicating that high school principals play a pivotal role in school decisions, and that the decisions the principals make are based on their perceptions and attitudes.

Due to their leadership role, principals' perceptions and attitudes about a new curriculum could either result in increased educational opportunities for students or in limited efforts to introduce curricular change (Praisner, 2003). McCray, Wright, and Beachum (2004) indicated that it is the school principal who sets the school climate that facilitates educational change. When implementing curricular change, "a principal's leadership is seen as the key factor for success" (Praisner, p. 135).

The Center for Comprehensive School Reform and Improvement (2005) indicated that school principals are under intense scrutiny in recent year to assure their schools are effective and their students successful. Most principals feel this tremendous pressure to have their schools and students be successful (Reed, McDonough, Ross, & Robichaux, 2001). Reed, et. al. went on to note that in our climate of high stakes testing, the pressure to perform is a driving force on the acceptance of educational change. Therefore it is essential to assess the attitudes and perceptions of Indiana high school principals toward the implementation of PLTW, the educational change initiative, if that initiative is to be successful across the state.

Research Questions

The following research questions were addressed by this study.

1. What are the perceptions of Indiana high school principals of the effect of PLTW on their schools?
2. What is the relationship between Indiana high school principals' personal characteristics, experience, and school characteristics and their attitudes toward PLTW?

Methodology

Instrument

In order to address each of these research questions, this study used a survey technique to ascertain the perceptions of Indiana high school principals related to the effect of PLTW on their schools. The survey instrument was developed based on the Principals and Inclusion Survey (PIS) (Praisner, 2003). The PIS was designed to determine the extent that different variables were related to the attitudes of school principals. The PIS contains four sections: (a) demographic information, (b) experience, (c) attitudes toward inclusion, and (d) principals' beliefs about most appropriate placement (Praisner). Permission was obtained from Praisner (2005, personal communication) to modify and use the PIS for the purposes of this research.

The survey instrument used for this study contained five sections: (a) demographic information, (b) experience, (c) effect of PLTW on students, (d) effect of PLTW on teachers, and (e) overall effect of PLTW (qualitative data). Respondents were asked to rate the effect of PLTW on both teachers and students in their high school, sections three and four, using a five-point Likert-type scale (Praisner, 2003). The Likert-type scale was suggested for this type of use by both Zargari (1996) and McCall (2001). McCall noted that "the words of the Likert scale are converted in a meaningful way to an interval scale that gives the researcher the ability to use totals or to calculate numerical averages" (p. 2). The five-point Likert-type scale consisted of 5) positive effect, 4) somewhat positive effect, 3) no effect, 2) somewhat negative effect, and 1) negative effect as suggested by Rollings, Burnett, and Huh (1996). Section five of the survey instrument collected qualitative data based on an open-ended question as to the principals' perception of the overall effect of PLTW on their high school.

Population and Sample

The population and sample for this study consisted of all Indiana high school principals whose schools had implemented PLTW prior

to the 2006-2007 academic year. These 57 high school principals were mailed a cover letter, survey instrument, and a postage-paid return envelope. The response rate was 64.9% (n = 37). The majority of these principals were male (78.4%, n = 29), were over 50 years of age (64.9%, n = 24), and had spent more than 10 years in school administration (70.2%, n = 26). These data can be seen in Table 1. The majority of the high schools enrolled over 500 students (86.4%, n = 32) and were in their first three years of PLTW implementation (71.4%, n = 25). Demographic descriptions of the PLTW high schools are also noted in Table 1.

Findings

The principals noted a strong positive effect of PLTW on the motivation and enthusiasm of their students (M = 4.93, SD = 0.254). This positive effect of PLTW was continued when the principals indicated that their students' critical thinking skills and problem-solving skills also received a strong positive effect by PLTW (M = 4.86, SD = 0.351; M = 4.86, SD = 0.351). As shown in Table 2, the principals rated PLTW as also having a positive effect on the students' career awareness in engineering (M = 4.84, SD = 0.598). PLTW's effect on academic subjects, such as mathematics, science, and language arts, was also indicated as positive by this sample of PLTW high school principals.

The overall effect of PLTW on teachers as noted by these high school principals is also provided in Table 2. The principals indicated that the teachers' use of relevant curriculum was a strong positive effect (M = 4. 81, SD = 0.401). The effect of PLTW on the motivation and enthusiasm of the teachers received a strong rating by these principals (M = 4.75, SD = 0.439). The principals also noted that the teaming of PLTW teachers with mathematics and science teachers had a positive effect (M = 4.11, SD = 0.785).

Table 1.
Demographic Data

PLTW Principals	N = 38	
Gender		
Female	8	(21.6%)
Male	29	(78.4%)
Age level		
50 years or less	13	(35.1%)
51 to 60 years of age	19	(51.4%)
Over 61 years of age	5	(13.5%)
Total years in education		
Less than 20 years	2	(5.4%)
Over 21 years	35	(94.6%)
Years in administration		
Less than 10 years	11	(29.7%)
11-20 years	13	(35.1%)
Over 21 years	13	(35.1%)
Year as this school's principal		
0 to 5 years	20	(54.1%)
6 to 10 years	6	(16.2%)
11 to 15 years	7	(18.9%)
Over 16 years	4	(10.8%)
PLTW Schools		
School size		
Less than 500 students	5	(13.5%)
501 to 1000 students	14	(37.8%)
Over 1000 students	18	(48.6%)
School grade level		
7th through 12th grade	4	(10.5%)
9th through 12th grade	33	(89.5%)
Years offering PLTW		
1st year	2	(5.7%)
2nd year	10	(28.6%)
3rd year	13	(37.1%)
4th year	5	(14.3%)
5th year	4	(11.4%)
6th year	1	(2.9%)

Table 2.
Overall Effect of PLTW

On Students	M	SD	n
Motivation/enthusiasm	4.93	0.254	37
Critical thinking skills	4.86	0.351	36
Problem-solving skills	4.86	0.351	36
Success in mathematics	4.39	0.645	36
Success in science	4.37	0.598	35
Success in language arts	4.09	0.658	35
Career awareness in engineering	4.84	0.598	37
On Teachers			
Relevant curriculum	4.81	0.401	36
Motivation and enthusiasm	4.75	0.439	36
Teaming with math/science faculty	4.11	0.785	36

Effect of PLTW on Students

Comparisons of the principals' perceptions of the effect of PLTW on students are shown in Table 3. Female principals rated PLTW's effect on the motivation and enthusiasm of their students higher than their male counterparts (M = 5.00, SD = 0.00; M = 4.72, SD = 0.455; df = 35, t = 1.70). This higher rating was also noted for the effect of PLTW on the students' critical thinking skills (M = 5.00, SD = 0.00) and problem-solving skills (M = 5.00, SD = 0.00), where, like motivation and enthusiasm, all eight of the female principals indicated the highest Likert-type rating of 5.0 or "positive effect." However, no significant differences were indicated between the male and female PLTW principals.

In general, principals with six or more years of tenure at their schools indicated a slightly higher rating than the newer principals. However, T-tests indicated no significant differences between principals based on their tenure. Younger principals less than 60 years of age, in general, posted a slightly higher rating that their older counterparts. Overall, no significant differences were indicated by the ANOVAs conducted based on the principals' age group. An examination of the principals' rating on the effect of PLTW on students by their years in school administration also indicated no significant differences. The principals' perceptions of PLTW based

Table 3.
Effect of PLTW on Students

By Principals' Gender	Female			Male		
Effect	M	SD	n	M	SD	n
Motivation and enthusiasm	5.00	0.000	8	4.72	0.455	29
Career awareness in engineering	4.88	0.354	8	4.83	0.384	29
Critical thinking skills	5.00	0.000	8	4.82	0.390	28
Problem-solving skills	5.00	0.000	8	4.82	0.390	28
Success in mathematics	4.50	0.535	8	4.36	0.678	28
Success in science	4.50	0.535	8	4.29	0.659	28
Success in language arts	4.12	0.641	8	4.11	0.641	27

By Principals' Tenure	0-5 years			6 or more years		
Effect	M	SD	n	M	SD	n
Motivation and enthusiasm	4.79	0.419	19	4.82	0.393	17
Career awareness in engineering	4.90	0.308	20	4.82	0.393	17
Critical thinking skills	4.85	0.366	20	4.88	0.342	16
Problem-solving skills	4.85	0.366	20	4.88	0.342	16
Success in mathematics	4.45	0.605	20	4.38	0.619	16
Success in science	4.35	0.587	20	4.40	0.632	15
Success in language arts	4.10	0.641	20	4.27	0.594	15

Table 3 continues

Table 3. *(continued)*

By Principals' Age Group	less than 50			51-60			61 and over		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	4.77	0.439	13	4.84	0.375	19	4.60	0.548	5
Career awareness in engineering	4.85	0.376	13	4.89	0.315	19	4.80	0.447	5
Critical thinking skills	4.75	0.452	12	4.95	0.229	19	4.80	.0447	5
Problem-solving skills	4.92	0.289	12	4.89	0.315	19	4.60	0.548	5
Success in mathematics	4.50	0.522	12	4.42	0.607	19	4.20	0.837	5
Success in science	4.42	0.515	12	4.47	0.513	19	4.25	0.957	5
Success in language arts	4.17	0.718	12	4.16	0.501	19	3.75	0.957	4

By Principals' Years in Administration	less than 10			11-20			21 and over		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	4.82	0.405	11	4.62	0.506	13	4.92	0.277	13
Career awareness in engineering	4.82	0.405	11	4.77	0.439	13	4.92	0.277	13
Critical thinking skills	4.82	0.405	11	4.00	0.376	13	4.92	.0289	12
Problem solving skills	4.82	0.405	11	4.92	0.277	13	4.83	0.389	12
Success in mathematics	4.64	0.674	11	4.23	0.599	13	4.33	0.651	12
Success in science	4.55	0.688	11	4.15	0.555	13	4.55	0.522	11
Success in language arts	4.36	0.809	11	3.85	0.555	13	4.27	0.467	11

Table 3 continues

Table 3. *(continued)*

By School Size	less than 500			501-1000			over 1000		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	5.00	0.000	5	4.79	0.426	14	4.72	0.461	18
Career awareness in engineering	4.80	0.447	5	4.79	0.426	14	4.89	0.323	18
Critical thinking skills	4.80	0.447	5	4.85	0.376	13	4.89	.0323	18
Problem-solving skills	4.80	0.447	5	4.85	0.376	13	4.89	0.323	18
Success in mathematics	4.60	0.548	5	4.15	0.801	13	4.50	0.514	18
Success in science	4.40	0.548	5	4.23	0.725	13	4.47	0.514	17
Success in language arts	4.20	0.447	5	3.85	0.801	13	4.24	0.562	17

By Years in PLTW	1-2 years			3 years			4-6 years		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	4.67	0.492	12	5.00	0.000	13	4.60	0.516	10
Career awareness in engineering	4.83	0.389	12	4.92	0.277	13	4.70	0.483	10
Critical thinking skills	4.82	0.405	11	4.92	0.277	13	4.80	.0422	10
Problem-solving skills	4.91	0.302	11	4.85	0.376	13	4.80	0.422	10
Success in mathematics	4.09	0.539	11	4.46	0.660	13	4.50	0.707	10
Success in science	4.10	0.568	10	4.54	0.519	13	4.40	0.699	10
Success in language arts	4.00	0.667	10	4.42	0.515	12	3.80	0.632	10

on the size of their high school generally noted very little difference. Based on ANOVA tests, no significant difference were indicated among the principals from different size high schools.

The results of comparisons of the principals' perception of the effect of PLTW based on the number of years their school had offered PLTW indicated no significant differences. However, two comparisons are worth examining if the sample is divided into two groups, first or second year of implementation, and three or more years of implementation. The principals whose schools had offered PLTW three or more years perceived the effect of PLTW on students related to success in mathematics higher than principals from schools just starting to offer PLTW. The mean for principals (n = 23) from schools offering PLTW three to six years was 4.48 (SD = 0.655), while principals from schools in their first two years of PLTW (n = 11) was 4.09 (SD = 0.539) (df = 32, t = 1.68). This difference in the principals' perceptions was also noted related to the effect of PLTW's effect on student success in science. The mean for beginning schools (n = 10) was M = 4.10 (SD = 0.568), while high schools that had the program in place for three to six years (n = 23) indicated a mean of M =4.48 (SD = 0.593) (df = 31, t = 1.70).

Effect of PLTW on Teachers

Table 4 indicates the overall perception of the effect of PLTW on the school's teachers. Male principals perceived the effect of PLTW on teachers' motivation and enthusiasm, and the use of relevant curriculum slightly higher than their female counterparts, while female principals viewed the effect of PLTW more positively than males related to teaming with mathematics and science faculty. However no significant differences were noted based on principals' gender.

Principals with a longer tenure at their school (M =4.88, SD = 0.322, n = 17) noted a higher positive effect of PLTW on their teachers' motivation and enthusiasm than those with less than five years tenure (M = 4.63, SD = 0.496, n = 19). In examining the principals' perception of PLTW by their age group, no significant differences were indicated. School administrators with over 21 years of experience (n =13) noted a higher positive perception of the effect

Table 4
Effect of PLTW on Teachers

By Principals' Gender	Female			Male		
Effect	M	SD	n	M	SD	n
Motivation and enthusiasm	4.50	0.535	8	4.82	0.390	28
Use of relevant curriculum	4.75	0.463	8	4.82	0.390	28
Teaming with math/science faculty	4.25	0.886	8	4.04	0.793	28

By Principals' Tenure	0-5 years			6 or more years		
Effect	M	SD	n	M	SD	n
Motivation and enthusiasm	4.63	0.496	19	4.88	0.332	17
Use of relevant curriculum	4.74	0.452	19	4.88	0.332	17
Teaming with math/science faculty	4.16	0.834	19	4.00	0.791	17

Table 4 continues

Table 4. (continued)

By Principals' Age Group	less than 50			51-60			61 and over		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	4.77	0.439	13	4.79	0.419	19	4.60	0.548	5
Use of relevant curriculum	4.85	0.376	13	4.79	0.419	19	4.80	0.447	5
Teaming with math/science faculty	4.31	0.751	13	4.11	0.737	19	4.00	1.00	5

By Principals' Years in Administration	less than 10			11-20			21 and over		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	4.55	0.522	11	4.69	0.480	13	5.00	0.000	13
Use of relevant curriculum	4.82	0.405	11	4.69	0.480	13	4.92	0.277	13
Teaming with math/science faculty	4.09	0.944	11	3.85	0.689	13	4.31	0.751	13

Table 4 continues

Table 4. (continued)

By School Size	less than 500			501-1000			over 1000		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	4.80	0.447	5	4.69	0.480	14	4.83	0.383	18
Use of relevant curriculum	5.00	0.000	5	4.64	0.497	14	4.89	0.323	18
Teaming with math/science faculty	4.00	1.000	5	4.07	0.829	14	4.11	0.758	18

By Years in PLTW	1-2 years			3 years			4-6 years		
Effect	M	SD	n	M	SD	n	M	SD	n
Motivation and enthusiasm	4.83	0.389	12	4.85	0.376	13	4.67	0.500	9
Use of relevant curriculum	4.92	0.289	12	4.77	0.439	13	4.78	0.441	9
Teaming with math/science faculty	4.08	0.669	12	4.31	0.751	13	4.11	0.782	9

of PLTW on their teachers' motivation and enthusiasm (M = 5.00, SD = 0.00) than principals with less experience (n = 24) (M = 4.55, SD = 0.522; M = 4.69, SD = 0.480).

Data related to the principals' perception of PLTW's effect on their teachers related to their high school's size noted no significant differences. Information related to the principals' perception of PLTW on their teachers based on the number of years their high school had offered PLTW again noted no significant differences.

Overall Effect of PLTW

Of the 37 principals responding, 30 (81.1%) provided qualitative descriptions on the overall effect of PLTW on their high school; 93.3% of these school principals noted that PLTW had a positive effect on their high school. Table 5 presents the qualitative descriptions of these principals' comments; only the main concept(s) of their statements are tabulated.

Table 5.
The Overall Effect of PLTW

Principals' major statements	n
Students are challenged and motivated	11
General positive effect on the school	10
Teachers are renewed and motivated	9
Renewed interest in technology education	5
Articulated and focused curriculum	5
Engineering career focus	5

The principal of a large suburban high school commented, "I firmly believe that this program has had a dramatic and positive impact on our school, faculty, students, and counselors." A principal from a smaller high school said, "It has been a very positive addition to our small school." A second principal commented, "I can't imagine not having it." Another noted, "Our students are better prepared for engineering."

One principal noted that "PLTW has been a great addition to our curriculum. It has been a course where students learned to think." Another principal commented that his teacher "has been rejuvenated

by this curriculum." "I have seen a tremendous positive impact on the technology education department with PLTW. Teachers are enthusiastic," was the statement provided by one principal. Another principal noted that PLTW "has energized an already super technology education staff." Another noted that PLTW "has provided focus to our technology education department." One of the younger principals stated that PLTW's "most positive impact to date has been the work with teachers. They have come back renewed and are better teachers as a result of Purdue University's professional development.

Conclusions

The results of this study indicated that Indiana high school principals have a very strong positive perception of the effect of PLTW on their schools, their teachers, and their students. These principals have indicated their positive perceptions of PLTW via both quantitative Likert-type scale ratings and qualitative open-ended comments related to PLTW. This research did not determine any significant difference between the high school's demographics or the personal characteristics of these Indiana high school principals related to their perception of PLTW.

Principals noted a strong positive effect on their students' motivation and enthusiasm as a result of offering the PLTW technology education curriculum. This positive effect on students' motivation and enthusiasm was also noted as a positive effect of PLTW on their schools' technology education teachers. The use of relevant technology education curriculum by teachers was also rated as a positive benefit of PLTW by this sample of high school principals.

The effect of PLTW on high school students' critical thinking skills and their problem solving skills were also rated by these principals as a strong positive benefit of offering PLTW in their school. Principals whose high schools had offered PLTW three or more years noted a higher positive effect mean for both PLTW's effect on success in mathematics ($M = 4.48$) and success in science

(M = 4.48) than principals whose high school had just implemented PLTW (M = 4.09 and M = 4.10 respectively).

The qualitative responses from these high school principals provided a very positive reflection on the effect PLTW has on the high school environment. Principals noted that PLTW provided a very positive impact on their school's students, teachers, and overall school culture. This study provides further evidence of the positive impact that PLTW offers schools and in particular the technology education discipline.

References

Center for Comprehensive School Reform and Improvement. (2005). *The role of principal leadership in improving student achievement*. Washington, DC: Office of Elementary and Secondary Education.

Evans, L. & Teddie, C. (1993). Principals' change facilitator styles in schools that differ in effectiveness and SES. Paper presented at the annual meeting of the American Educational Research Association, Atlanta, GA.

Harris, E. L. (2005). *Key strategies to improve schools: How to apply them contextually*. Landham, MD: Rowman & Littlefield.

Hipp, K. A., & Huffman, J. B. (2000). How leadership is shared and visions emerge in the creation of learning communities. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

McCall, C. H. (2001). *An empirical examination of the Likert scale: Some assumptions, development and cautions*. Paper presented at the annual meeting of the CERA Conference, South Lake Tahoe, CA.

McCray, C. R., Wright, J. V., & Beachum, F. D. (2004). An analysis of secondary school principals' perceptions of multicultural education. *Education, 125*(1), 111.

Nanus, B. (1992). *Visionary leadership: Creating a compelling sense of directions for your organization.* San Francisco: Jossey-Bass.

Nwanne, A. I. (1996). The perceptions of public school principals in the state of Texas toward selected United States Supreme Court decisions concerning desegregation issues. (ERIC Document Reproduction Service: ED 301921).

Praisner, C. L. (2003). Attitudes of elementary school principals toward the inclusion of students with disabilities. *Exceptional Children, 69*(2), 135-145.

Project Lead The Way. (2005). *About Project Lead The Way: An overview*. Clifton Park, NY: Author. Retrieved from http://www.pltw.org

Reed, C. J., McDonough, S., Ross, M., & Robichaux, R. (2001). Principals' perceptions of the impact of high stakes testing on empowerment. Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA.

Rogers, G. E. (2005). Pre-engineering's place in technology education and its effect on technological literacy as perceived by technology education teachers. *Journal of Industrial Teacher Education, 42*(3), 6-22.

Rollings, P. C., Burnett, M. F., & Huh, M. (1996). Principals' perceptions of non-traditional gender vocational teachers. *Journal of Vocational and Technical Education, 12*(2), 29-39.

Zargari, A. (1996). Survey results guide total quality management (TQM) course development in industrial technology, *Journal of Technological Studies, 22*(1), 60-61.