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Perceptions of Indiana Parents Related to Project Lead The Way

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Introduction

The nation's public schools serve as the foundation for preparing a workforce that is literate in science, technology, engineering, and mathematics (The National Academies, 2007). In the report, *Rising above the gathering storm: Energizing and employing America for a brighter economic future*, members of The National Academies identified that meaningful and high-wage employment in the new global economy will require technological literacy and engineering skills. Furthermore, the report strongly recommended that ensuring all students develop these technological workplace skills should be the mission of our public schools (The National Academies). Obtaining these essential skills will provide today's students, as well as tomorrow's workers, with "the opportunity to become part of a cadre of world-class scientists and engineers who can create the new products that

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will in turn broadly enhance the nation's standard of living" (The National Academies, p. 135). The National Academies went on to note that high-quality secondary engineering instruction is grounded in a high-quality and rigorous K-12 engineering curriculum.

Integrating Project Lead The Way

According to Douglas, Iversen, and Kalyandurg (2004), teaching engineering classes in high school has also been supported by the American Society of Engineering Education. Furthermore, Colvin (2005) indicated that the push for secondary engineering education was fueled by concern of a predicted future shortage of engineers in the United States. The National Academies (2007) stated that Project Lead The Way (PLTW) was the model engineering curriculum to address the nation's technological workforce needs. PLTW was introduced in 12 New York high schools in 1997 (Blais & Adelson, 1998). Since then schools across the country have adopted the PLTW engineering program. In 2008, the PLTW curriculum was offered by schools in all 50 states and the District of Columbia and totaled 3,000 schools (PLTW, 2008). The purposes of PLTW are to develop technologically literate high school graduates, to generate interest in engineering-related fields, and to encourage high school students to pursue engineering as a career pathway. PLTW's target population was students that are already on a college career path, such as honors or academic honors high school diploma. The curriculum that PLTW developed was rigorous, demanding, and designed to help students prepare to study engineering careers in the future (Kelley, 2008). The PLTW program offers seven engineering courses in its high school engineering curriculum.

High schools in Indiana have implemented PLTW curriculum into their schools since 2001. Indiana technology education teachers have accepted PLTW as a beneficial component of technology education, even though the PLTW is a departure from the standard technology education curriculum (Rogers, 2005). In 2006, Indiana schools offering PLTW programs grew to 231 schools; an increase of 45 % from 2005. With this increase, Indiana became the nation's leader in implementing the PLTW curriculum (PLTW, 2006.).

Parental Influence

In order for the PLTW curriculum to expand, recruit, and educate more students it is important for parents to understand what the PLTW engineering curriculum has to offer their sons or daughters. Studies have indicated that parents play the most significant role in adolescents' career decision making (Hoffman, St. Louis, & Hoffman, 2010; Noel-Levitz, 2009; Otto, 2000; Saiti & Mitrosili, 2005). "Parental involvement can certainly play a large role in the college decisions of perspective students" (Noel-Levitz, p. 5).

Both Noel-Levitz (2009) and Teachman and Paasch (1998) have noted that the family income and the educational level of the child's parents can both have an effect on the child's career decision. Additionally, the occupation of the child's mother and father has shown to influence students' career paths (Trice, 1991). Hoffman, St. Louis, and Hoffman (2010) noted that parents who are engineers shape their daughters' perception of an engineering career pathway. Mothers have been shown to have a greater influence on a child's career decisions than fathers (Mickelso & Velasco, 1998).

Saiti and Mitrosili (2005) noted that parents' involvement in guiding their child's career decisions has

become a concern with educational policy makers. The departments of education in some states have created programs to help parents partner with their children to determine the most appropriate career choice (Kucker, Smith-Rockhold, Bemis, & Wiese, 1998). Likewise, programs that provide instruction to lead to a career pathway in engineering should also include looking to parents as an important partner to recruit and retain students in these courses. However, it is unclear how knowledgeable parents of PLTW students are regarding the PLTW program.

Problem Statement

Currently there is a lack of data related to parents' perceptions of high school engineering education (PLTW) and its effect on their child's career goals.

Purpose of the Study

The purpose of this study was to determine the current perceptions of PLTW held by parents of students enrolled in PLTW engineering courses at one Indiana high school. This study was guided by the following research questions:

1. What are the current perceptions held by parents about Project Lead the Way?
2. Does a parent's income affect their perception of PLTW?
3. Does a parent's gender affect their perception of PLTW?
4. Does a parent's level of education affect their perception of PLTW?

Methodology

This descriptive research study gathered information from a high school in northeastern Indiana. Best and Kahn (2006) suggested that a quantitative survey was best suited for this type of construct and their procedures were followed to develop the survey instrument. The population and sample of this study considered all parents ($N = 147$) who had a child

enrolled during the second semester of the 2009 school year in one or more of the PLTW classes offered by the school, which included *Principles of Engineering* (54 parents), *Introduction to Engineering Design* (75 parents), and *Civil Engineering and Architecture* (18 parents) courses. The response rate of the parents was 57.1% (N = 80).

The survey instrument collected demographic information and contained questions that had been modified from a similar study (Rogers, 2006). The demographic information consisted of five categories: a) highest level of education completed; b) family's gross income per year; c) ethnicity; d) gender; and d) employment. Parents' perceptions were assessed based on these five statements:

1. PLTW classes benefit my child.
2. After taking a PLTW class, my child has more knowledge of engineering.
3. My child is more interested in an engineering career.
4. My child is more likely to major in engineering in college.
5. PLTW classes have taught my child concepts that have helped him/her in other classes.

The respondents rated each statement using a five-point Likert-type scale, with Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, and Strongly Disagree = 1.

Limitations of the Study

1. Due to various constraints, this study was limited to one Indiana high school.
2. Conclusions drawn from this study may only be applied to one Indiana high school. This study's findings cannot be generalized to the entire national population of PLTW parents.

Results

All responding parents had completed high school. Nearly equal proportions of respondents reported three primary

levels of education with 27.8% of parents indicated completing some college education/associate degree, 25.3% noting they had earned a bachelor's degree, and 26.6% had a received a high school diploma/GED. Table 1 outlines the highest level of education completed by the respondents.

Table 1. Highest level of education completed

Level of Education Completed	<i>n</i>	%
Associate degree or some college	22	27.8 %
High school graduate/GED	21	26.6 %
Bachelor's degree	20	25.3 %
Post baccalaureate credits	6	7.6%
Master's degree	10	12.7 %
Doctoral degree	0	0 %

Sixty-two parents (81.6%) indicated that their family income was \$50,000 or more per year. The largest income level reported was \$100,000 or above (35.1%, *n* = 27). A family income of \$49,999 and below accounted for the smallest percentage reported (19.5%, *n* = 15). Gross family annual income is noted in Table 2.

Table 2. Gross family annual income

Family's Gross Income per Year	<i>n</i>	%
\$0-\$24,999	3	3.9 %
\$25,000-\$49,999	12	15.6 %
\$50,000-\$74,999	16	20.8 %
\$75,000-\$99,999	19	24.7 %
\$100,000 or above	27	36.1 %

Parents were asked to indicate their ethnicity. Parents who indicated white-non Hispanic represented the largest group ($n = 70$, 87.5%). (See Table 3) When asked to indicate their gender, 67.1% ($n = 53$) indicated gender as female. (See Table 4) This indicated that mothers of students completed the majority of the surveys.

Table 3. Ethnicity

Ethnicity	<i>n</i>	%
African American; Black	0	0 %
Asian American; Pacific Islander	3	3.8 %
White; Non-Hispanic	70	87.5 %
Hispanic; Latino(a)	4	5 %
Native American; Alaska Native	0	0 %
Other	1	1.3%
Prefer not to respond	2	2.5%

Table 4. Gender

Gender	<i>n</i>	%
Male	26	32.9 %
Female	53	67.1 %

Parents were asked to indicate their type of employment. The survey revealed that 20 respondents (25.6%) were employed in a managerial position. Equal percentages of parents were employed in the education (15.4%, $n = 12$) and professional areas (M.D., Lawyer, DVM, etc.) (15.4%, $n = 12$). Clerical, skilled trades/crafts, sales/marketing, and service accounted for the remaining ($n = 34$, 43.6%) respondents. Table 5 notes employment information from survey respondents.

Table 5. Type of Employment

Type of Employment	<i>n</i>	%
Clerical	8	10.3 %
Education	12	15.4 %
Managerial	20	25.6 %
Professional	12	15.4 %
Sales/Marketing	9	11.5 %
Service	7	9.0%
Skilled Trades/Crafts	10	12.8%

The college credit section revealed that 60.8% ($n = 48$) of the parents surveyed were aware that their child could receive college credit for PLTW classes. However, 39.2% ($n = 31$) of the respondents were not aware that college credit could

be earned by taking PLTW classes. Even though 60.8% of parents knew that their child could receive college credit for completing PLTW classes only 21.5% ($n = 17$) indicated they knew which colleges accepted PLTW college credits. Parents' perceptions of the PLTW college credit are noted in Table 6.

Table 6. College Credit for PLTW classes

College Credit for PLTW classes	<i>n</i>	%
Awareness that college credit is available		
Yes	48	60.8 %
No	31	39.2 %
Knowledge which colleges accept PLTW credit		
Yes	17	21.5 %
No	62	78.5 %

A total of 96.1% ($n = 75$) of the parents indicated they thought PLTW classes would benefit their child. When asked if their child has more knowledge of engineering after taking a PLTW class, parents responded positively with 94.9% ($n = 74$) by noting they agreed or strongly agreed with this statement. Concerning the statement, my child is more interested in an engineering career, the response was 70.8% ($n = 55$) strongly agree or agree with the statement. However, 24.4% ($n = 19$) were neutral on whether their child is more interested in an engineering career after taking a PLTW class. Forty-two parents (54.6%) indicated that they strongly agreed or agreed that their child is more likely to major in engineering in college because of taking a PLTW course. Contrasted by 37.7% ($n = 29$) who noted a neutral response to this item. Concerning the statement that PLTW classes have taught my child concepts that have helped him/her in other classes, 45.5% ($n = 35$) of the

parents indicated agreement, and 33.8% (n = 26) noted they strongly agree. A complete breakdown of the parents' responses can be seen in Table 7.

Table 7. Level of agreement with the following statements

	Strongly Agree		Agree		Neutral	
	n	%	n	%	n	%
PLTW classes benefit my child.	43	55.1	32	41.0	2	2.6
After taking a PLTW class, my child has more knowledge of engineering.	46	59.0	28	35.9	3	3.8
My child is more interested in an engineering career.	32	41.3	23	29.5	19	24.4
My child is more likely to major in engineering in college.	32	41.6	10	13.0	29	37.7
PLTW classes have taught my child concepts that have helped him/her in other classes.	26	33.8	35	45.5	12	15.6

Table 7 (continued).

	Disagree		Strongly Disagree		M	SD
	n	%	n	%		
PLTW classes benefit my child.	1	1.3	0	0	4.50	0.61
After taking a PLTW class, my child has more knowledge of engineering.	1	1.3	0	0	4.50	0.63
My child is more interested in an engineering career.	3	3.8	1	1.3	4.05	0.96
My child is more likely to major in engineering in college.	4	5.2	2	2.6	3.85	1.10
PLTW classes have taught my child concepts that have helped him/her in other classes.	3	3.9	1	1.3	4.06	0.87

Mean Likert-type scale responses noted that parents indicated that PLTW classes were beneficial to their son or daughter ($M = 4.50$, $SD = 0.61$) and that their child was more knowledgeable about engineering as a result of the PLTW course ($M = 4.50$, $SD = 0.63$). Overall, parents agreed their children were more interested in engineering following a PLTW course ($M = 4.05$, $SD = 0.96$) and that the PLTW course taught their son or daughter concepts that helped in other coursework ($M = 4.06$, $SD = 0.87$). Parents were less in agreement that their child was more likely to major in engineering following a PLTW course ($M = 3.85$, $SD = 1.10$). However, a mean of 3.85 still noted agreement with this statement.

Responses of the parents based on their reported annual income noted overall strong agreement with PLTW courses benefitting their children ($M = 4.3$ to $M = 4.6$) and that the

PLTW course made their child more knowledgeable about engineering ($M = 4.3$ to $M = 4.8$). (See Table 8.) Two items noted a slight disparity between income levels. Parents whose annual income was between \$25,000 and \$75,000 noted their child was more interested in engineering following a PLTW course ($M = 4.2$ to $M = 4.3$), while parents with an income of less than \$25,000 per year indicated a neutral opinion ($M = 3.3$, $SD = 0.57$). This was also indicated related to their child being more likely to major in engineering in college ($M = 4.2$ & 4.0 to $M = 3.3$).

Table 8. Means by gross family income

	<u>\$0-\$25K</u>		<u>\$25K-\$49K</u>		<u>\$50K-\$75K</u>	
	M	SD	M	SD	M	SD
PLTW classes benefit my child.	4.3	0.57	4.5	0.90	4.5	0.74
After taking a PLTW class, my child has more knowledge of engineering.	4.3	0.57	4.8	0.45	4.4	0.82
My child is more interested in an engineering career.	3.3	0.57	4.2	1.10	4.3	0.89
My child is more likely to major in engineering in college	3.3	0.57	4.2	1.20	4.0	1.20
PLTW classes have taught my child concepts that have helped him/her in other classes.	4.0	0.00	4.3	0.77	3.7	1.10

Table 8 (continued)

	<u>\$75,000-\$100K</u>		<u>\$100K-Above</u>	
	M	SD	M	SD
PLTW classes benefit my child.	4.6	0.49	4.4	0.50
After taking a PLTW class, my child has more knowledge of engineering.	4.6	0.68	4.5	0.57
My child is more interested in an engineering career.	3.9	1.10	4.1	0.83
My child is more likely to major in engineering in college	3.8	1.08	3.8	1.06
PLTW classes have taught my child concepts that have helped him/her in other classes.	4.2	0.89	4.1	0.76

Male parents noted very strong agreement with PLTW classes being beneficial to their child ($M = 5.0$, $SD = 0.58$), while mothers did not indicate as strong an agreement ($M = 4.5$, $SD 0.63$). Other responses compared by gender indicted very little difference based on gender of the parent. Responses based on the gender of the parent are noted in Table 9.

Table 9. Means by Gender

	<u>Male</u>		<u>Female</u>	
	M	SD	M	SD
PLTW classes benefit my child.	5.0	0.58	4.5	0.63
After taking a PLTW class, my child has more knowledge of engineering.	4.5	0.58	4.5	0.81
My child is more interested in an engineering career.	4.2	0.77	4.0	1.03
My child is more likely to major in engineering in college.	4.0	0.99	3.8	1.15
PLTW classes have taught my child concepts that have helped him/her in other classes.	4.3	0.73	4.0	0.93

Discussion

As mentioned above, some studies have indicated that parents play the most significant role in adolescents' career decision making (Hoffman, St. Louis, & Hoffman, 2010; Noel-Levitz, 2009; Otto, 2000; Saiti & Mitrosili, 2005) and it is critical to locate methods to help parents to work with their children to select appropriate career choice (Kucker, Smith-Rockhold, Bemis, & Wiese, 1998). Considering the important role parents play in helping their children prepare for their future, the results of this study provides vital information for PLTW leadership, PLTW teachers, and PLTW students and parents. The study found that parents' perceptions of PLTW had the greatest variation in the understanding of college credit that can be earned for successfully completing PLTW classes. The PLTW parents surveyed possessed a limited knowledge when surveyed about college credit applied to PLTW courses. A total of 39.2% (n = 31) of parents were not aware that PLTW classes could earn college credit. Additionally, 78.5% (n = 62)

stated that they did not know what colleges and universities accepted the PLTW classes for credit. This is a critical finding when considering the influence parents have on their child's high school course selection and on their career choice (Quast, 2003).

Furthermore, many secondary education programs like PLTW are being cut or eliminated due to recent reduced state funding. The research findings presented here suggest that the parents of PLTW students are uninformed of the benefits of PLTW courses regarding college credits. PLTW leadership and PLTW teachers should develop better strategies to inform parents about the college credits available through PLTW.

Another interesting finding of this study was that demographics of the family's gross annual income affected parents' perceptions of PLTW. The study found that parents from families with incomes greater than \$25,000 believed that PLTW courses developed more interest in engineering for their child and that their child was more likely to enter engineering as a college major. However, families with an annual income of less than \$25,000 did not agree or were neutral that PLTW course generated interest in engineering or that their child was more likely to enter engineering as a college major. This finding may indicate that lower income parents do not see a college engineering pathway as an option for their sons and daughters. One possible reason for these results could be due to parents responding to this item based upon their limited ability to provide college tuition for their child. It is ironic that the population of PLTW students that could benefit the greatest from free college credit for PLTW courses are those of parents who perceive PLTW with limited or no benefit for their child regarding opportunities to pursue engineering at the college level. Armed with the results of this study, school officials, PLTW teachers, and PLTW leadership should develop strategies to address the need to inform parents about the

benefits of PLTW college credit options. Although the results of this study cannot be generalized to all PLTW programs around the nation, these results indicate that this is a feature of PLTW that should be communicated more clearly.

The research noted that mothers do not believe that PLTW classes are as beneficial for their child to the same degree as fathers. It is not clear whether both mothers and fathers completed the survey together and only the female demographic classification was marked or whether this is a valid disparity. However, in Rogers' (2007) study, female principals sampled indicated the highest Likert-type rating for the positive effect of PLTW on students' motivation, problem solving skills, enthusiasm, and critical thinking skills. Both studies indicated that female principals and both mothers and fathers felt PLTW classes were beneficial to their students and children.

Implications

This study generated two specific implications. These results should be shared with high school technology education teachers and counselors and pursued in future studies.

1. The finding that parents with a higher gross income had a strong perception of PLTW should lead teachers, counselors, and administrators to ensure that students from low socioeconomic families are provided career guidance for the engineering pathway.
2. The finding that fathers have higher rated perceptions of PLTW than mothers should be investigated further especially considering the finding of Mickelso and Velasco (1998) who noted that mothers have a greater influence on their child's career decisions than fathers.

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