The Effect of the STEM Curriculum, Project Lead the Way, on WELS Schools

by

Peter A. Gumm

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Date:

This thesis paper has been examined and approved.

Review Committee:

_____

Cindy Whaley, Chair

_____

Paul Tess

_____

Paul Boehlke

Approved:

_____

John Meyer

Director of Graduate Studies

Abstract

As of October 2019, only 9 of 28 WELS high schools (32%) and only 22 of 312 WELS elementary schools (7%) have implemented the Project Lead the Way (PLTW) curriculum. Although research studies have been done to measure the effect of PLTW on achievement, few studies go beyond that scope, and no studies are specific to WELS schools.

Therefore, there is currently only a limited amount of guidance that can be given to school leaders who are interested in implementing PLTW. The research data found in this study is meant to provide information that could potentially guide WELS educators.

All WELS high schools and grade schools that have implemented PLTW curriculum were identified. The 600 WELS teachers and administrators within those schools were asked to fill out an electronic survey to assess PLTW's impact on eight different categories of their ministry: effect on mission, climate and culture, teacher satisfaction and team morale, marketing/recruitment, enrollment, test scores, school-wide curriculum, and budget.

These were the recommendations based on the results: (1) WELS school leaders should explore PLTW implementation, (2) For school leaders that wish to pursue PLTW implementation, they ought to identify and plan for obstacles based on research, and (3) WELS should adequately prepare future PLTW instructors for teaching in WELS schools.

Acknowledgments

God has blessed me in countless ways throughout my life, providing me with an abundance of earthly blessings, people who have enriched my life, and experiences and memories that I will always cherish. He's provided an opportunity for me to serve in a setting I love at a ministry that has allowed me to develop my teaching skills and grow professionally. Much more than all this, He has called me to faith in His Son Jesus, and has assured me that an eternity in heaven is waiting for me! I thank God for these amazing blessings!

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Finally, many thanks to all the teachers who gave up their valuable time to offer responses to the survey that provide the basis for findings in this study.

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Chapter I: Introduction

Problem Statement

"Trinity Lutheran School exists...to equip children to be faithful stewards, evangelists, productive citizens in this world, and heirs of heaven" (Trinity Lutheran School Parent Handbook, 2018). "Shoreland Lutheran High School exists to educate, equip, and encourage students for lives of Christian service" (Shoreland Lutheran High School Parent/Student Handbook, 2019). Many elementary schools and high schools in the Wisconsin Evangelical Synod (WELS) have similar sentiments communicated in their mission statements. The WELS has a rich tradition of academic excellence and has operated highly-regarded schools for over 165 years to help meet its mission.

The primary purpose of WELS schools is to share God's Word with students. However, those schools also have the incredible opportunity to teach about God's world through history, math, science, art, languages, and all subjects. Skills and knowledge mastered in these various subjects ultimately prepare students to enter the workforce. The demand for STEM-related workers, and therefore STEM education, continues to increase (Van Overschelde, 2013). Consequently, WELS educators have the privilege of training the next generation of Christian engineers, Christian scientists, Christian doctors, and other Christian professionals in STEM-related occupations. But what is the best way to develop the "essential skills" (Muir, 2019) of collaboration, communication, critical thinking, and creativity that are typically the undercurrent of a STEM curriculum? Which STEM curriculum, if any, ought to be used? Are WELS students as exposed to STEM education as they should be?

In addition to publicly stated Christian-focused aspirations, the desire for educational excellence, including STEM, is also evident in the WELS. "We want only the best for God and his children. Our schools are like Mary's nard rolling down the head of Jesus (John 12:3). He deserves the best" (Patterson, 2011, p.11). Knowing the mission of the WELS and WELS schools, we should desire to do all things with high quality. We also are confident that God certainly has the power to bless the efforts of our teachers and students as we strive towards excellence.

Project Lead the Way (PLTW) is a nationwide nonprofit program headquartered in Indianapolis that develops activity-, project- and problem-based curricula designed to improve student learning in the STEM disciplines. They currently offer five programs: Launch (PreK-5), Gateway (6-8), Engineering (9-12), Bio-Med (9-12), and Computer Science (9-12). The impact of this curriculum is well-documented (Tai, 2012), and PLTW school participation has increased dramatically (Van Overschelde, 2013). Some WELS elementary schools and high schools have adopted PLTW curriculum at varying degrees of implementation ("Empowering PreK-12," 2019).

This study attempts to assess how the mission of the school, climate and culture, teacher satisfaction and team morale, marketing/recruitment, enrollment, test scores, school-wide curriculum, and budget have been affected in WELS schools which have implemented PLTW curriculum.

Purpose of the Study

By the time students graduate from high school, they are expected to have obtained a massive amount of knowledge and skills in various areas. Because many occupations require computation, creation or analysis of graphical data, critical thinking, collaboration, etc., STEM education programs are becoming increasingly commonplace as part of school curricula.

The National Assessment of Educational Progress reported that a staggering 75% of 12th-grade students in the United States performed below the "Proficient" level on the math portion of their assessment, and 78% below the "Proficient" level in science (The Nation's Report Card, 2017). The technology & engineering literacy mark was a bit higher, but still less than half the students (only 8th graders took this test) were "Proficient" in this category. There is certainly an opportunity for improvements in the areas of science, technology, engineering, and mathematics.

Will adopting the PLTW curriculum at the elementary school and/or high school level benefit WELS students? Will adopting the PLTW curriculum truly prepare students for lives of Christian service in STEM-related occupations? Will it be a benefit to the overall ministry, or simply an additional strain on the budget? Might a PLTW program be a marketing tool that will allow more students to sit at the feet of Jesus via our schools on a daily basis? School leaders who are contemplating such items may benefit from the data found in this study.

Specific Research Questions:

1. To what extent has the <u>mission of the school</u> been affected in schools that have
    implemented PLTW curriculum?

2. To what extent has the <u>school climate and culture</u> been affected in schools that have
    implemented PLTW curriculum?

3. To what extent has <u>teacher satisfaction and team morale</u> been affected in schools that
    have implemented PLTW curriculum?

4. To what extent has <u>marketing/recruitment</u> been affected in schools that have
    implemented PLTW curriculum?

5. To what extent has <u>enrollment</u> been affected in schools that have implemented PLTW
    curriculum?

6. To what extent have <u>standardized test scores</u> been affected in schools that have
    implemented PLTW curriculum?

7. To what extent has the <u>school-wide curriculum</u> been affected in schools that have
    implemented PLTW curriculum?

8. To what extent has the <u>school (or overall ministry) budget</u> been affected in schools that
    have implemented PLTW curriculum?

Assumptions and Limitations of the Study

Teacher participation in this study was purely voluntary. Therefore, the researcher had no control in the number of responses he received. There was also a potential for response bias from teachers as they provided responses that may be indicators of their own instructional methods or effectiveness.

A teacher that had previously taught a PLTW course but is no longer in a WELS school that has adopted the PLTW curriculum could potentially be "missed" even though their survey responses could be valuable. In order to counteract this deficiency (at least to a small degree), teachers who took the survey were asked to forward the survey to anyone they could think of who fit these criteria.

As Kelley and Knowles (2016) acknowledged in their conceptual framework for integrated STEM education, not all secondary education math content can be applied to engineering design approaches. Similarly, secondary education students may not have the cognitive development necessary to connect mathematical thinking within all engineering design problems. This disconnect may have affected survey results in teacher satisfaction and/or standardized test scores.

Finally, this study was meant to assess PLTW curriculum implementation in WELS schools and may not be beneficial to groups outside the WELS.

Overview

As stated previously, this study attempts to assess how WELS schools have been affected in a broad range of categories since their implementation of PLTW curriculum. WELS teachers and administrators who serve at schools that have implemented PLTW curriculum were surveyed about the impact to the mission of the school, climate and culture, teacher satisfaction and team morale, marketing/recruitment, enrollment, test scores, school-wide curriculum, and budget. Analysis of survey results is meant to highlight obstacles and blessings of PLTW implementation, providing guidance to WELS leaders in regard to possible adoption of the PLTW curriculum in the future.

Chapter II: Literature Review

Introduction

Across the globe, educators systematically study, discuss, and plan curriculum. They attempt to articulate the experiences they wish to provide for their students, whether as school-wide curriculum or within a specific course of study. They seek out resources that will best facilitate the desired instructional scope and sequence to produce the highest student achievement, all while weighing financial implications.

WELS educators also plan curriculum. However, WELS schools have a unique mission, teacher composition, financial structure, and resources that set them apart from others. As an untraditional STEM-based curriculum, PLTW offers its own uniqueness. Since PLTW curriculum is being implemented in some WELS schools, the effects of this implementation - like other curricula - ought to be evaluated.

In preparation for the research study, a broad selection of articles was needed and beneficial in providing a focused background of STEM education and its connection with PLTW and WELS schools. The information from the articles fell into the following categories:

1. STEM Education - What is it and what is it not?

2. History and Government Involvement in the Evolution of STEM

3. STEM Education Development, Limitations, and Challenges

4. A Conceptual Framework of STEM Education

5. What is PLTW?

6. Proven Effectiveness of PLTW

7. What is the Future of STEM Education?

8. WELS & PLTW

STEM Education - What is it and what is it not?

STEM generally stands for Science, Technology, Engineering, and Mathematics. (This acronym is now sometimes expanded to STEAM or STREAM, to include Arts and/or Reading and wRiting.) "However, the lack of a common definition for STEM has contributed to confusion, and even contradictory findings, in federal agencies, academic, and nonprofit research of the U.S. STEM workforce and labor supply" (Granovskiy, 2014, p.2). STEM education is more than just "something with science and computers." It is more than simply building with Legos. It is more than a process to encourage critical thinking.

Kelly and Knowles (2013) define integrated STEM education as "the approach to teaching the STEM content of two or more STEM domains, bound by STEM practices within an authentic context for the purpose of connecting these subjects to enhance student learning" (p.3). Sanders (2009) described integrated STEM education as "approaches that explore teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other school subjects" (p. 21).

Regardless of the specific definition, the characteristics of STEM education are contextual problems, integrated effort and/or collaboration, using current tools, a focus on

innovation and an applied process; and the production of critical thinking (Sanders, 2009;

Soyadı, Y. A., & Tertemiz, N., 2018; White, 2014). Based on this, STEM education could be,

but is not limited to, preschoolers who develop spatial sense as they engage in activities that

explore directional movement on their nature walk. STEM education could be, but is not limited

to, 4th graders who set up an experiment to help find ways to prevent the spread of illness.

STEM education could be, but is not limited to, high schoolers collaboratively designing

solutions for real-world manufacturing problems. There are a multitude of scenarios at different

age and intellect levels that reflect the characteristics of STEM education ("STEM Activities to

Use," 2016).

     "A well-designed and well-implemented curriculum introducing K-12 students to

STEM-related careers has the potential to have an impact on long-range outcomes" (Tai, 2012,

p.2). Sadly, STEM education has become somewhat of a catchphrase that is meant to produce the

idea of innovative hands-on teaching, but in reality does not differ from the traditional

segregated subject matter (Kelley and Knowles, 2016). To further the problem, secondary

education in the US will sometimes isolate STEM subjects within a fixed structure with

departmental agendas, requirements, content standards, and end-of-year examinations. Kelley

and Knowles (2016) believe that if these obstacles remain in education in the USA and around

the world, they may constrain the successful implementation of an integrated STEM program,

thus jeopardizing the entire STEM movement.

History and Government Involvement in the Evolution of STEM

President George Washington's request to Congress (in the first State of the Union address) to promote scientific knowledge for the sake of the republic is proof that STEM education, application, and focus are not simply a recent fad (Granovskiy, 2018). Historically, there have been plenty of examples of STEM concepts being utilized in the business world, such as inventions by Thomas Edison and others, or the Industrial Revolution. However, such concepts were missing from traditional educational settings at that time (White, 2014). The Morrill Act of 1862, however, was one example that changed this by providing grants of land to states to finance the establishment of colleges specializing in engineering among other things.

Other historical events also pushed STEM education to grow and flourish. World War II led to invented technologies such as the atomic bomb and other weapons, synthetic rubber, and transportation vehicles. Granovskiy (2018) states that the US has benefitted from a highly skilled STEM-focused workforce that has produced the social, economic, health, and military advances since WWII. The National Science Foundation (NSF) was established in 1950—in part—to "develop and encourage the pursuit of a national policy for basic research and education in the sciences" (p.23).

In 1957, the (then) Soviet Union launched Sputnik, a satellite to orbit the earth. This event started the "Space Race" between the US and Soviet Union. The United States organized the National Aeronautics and Space Administration (NASA) just a year later in an effort to compete. In 1965, the Elementary and Secondary Education Act and the Higher Education Act

were both authorized to provide federal aid to educational institutions in pursuit of STEM development.

These historical examples show that our government has been, and continues to be, interested in STEM-related education. Granovskiy (2018) outlines the structure of the current Federal STEM Policy Administration, where authority flows from the President down to the Office of Science and Technology Policy to the National Science and Technology Council to the Committee on STEM Education.

These government agencies have also allocated significant support ($3.4 million in 2010) towards STEM investments. The chart below shows that the largest shares of that financial allocation were for the following purposes: (1) increasing the number of post-secondary STEM degrees, (2) preparing people to enter into STEM careers, and (3) conducting STEM education research and development. The largest number of investments and the largest total funding were targeted toward undergraduate and graduate learners.

Figure 1

Federal STEM Education Funding by Primary Objective, FY2010 (Granovskiy, 2018)

In 2013, after evaluating these financial priorities from previous years, the Committee on STEM Education released a five-year strategic plan that moderately shifted the focus of STEM education investment areas: improve STEM instruction; increase and sustain youth and public engagement in STEM; enhance STEM experience of undergraduate students; better serve groups historically underrepresented in STEM fields; design graduate education for tomorrow's STEM workforce (Granovskiy, 2018).

STEM Education Development, Limitations, and Challenges

According to the U.S. Census Bureau, there were 7.2 million STEM workers (6% of the total workforce) in the United States in 2011. Van Overschelde's (2013) study found the following:

Growth in STEM-related jobs between 2008 and 2018 [was] expected to approach 20%; a rate that is almost twice the growth rate of non-STEM related jobs and twice the growth rate seen during the first decade of this century. Clearly, there is a need to educate a larger number of students who can fill these high paying STEM jobs. (p.1)

But how will STEM skills and knowledge among the U.S. population be created? The education system can be one major source. However, Kelley and Knowles (2016) remind us that there are many viewpoints about how to best produce the most proficient STEM students and workers, therefore continued research is necessary.

Perhaps the most notable obstacle to efficient and effective STEM education is the development of efficient and effective STEM teachers. Kelley and Knowles (2016) acknowledge that when teachers have a deep understanding of the content they are teaching along with domain pedagogical content knowledge, STEM education teaching will be strengthened. But some teachers feel unprepared because they do not all have a background of proper authentic scientific research and inquiry experiences. When their classroom instruction involves a series of tasks and hands-on lab activities, these teachers may view it as equivalent to scientific inquiry, which is a dangerous misconception (Kelly and Knowles, 2016). Rather, a goal in inquiry teaching is to provide a student with enough support that they construct the appropriate mental model through

their own educational journey, which strengthens the understanding and application of rules and

theories. Kelly and Knowles (2016) also argue that networking with fellow teachers and experts

in the field can be a daunting task, and therefore using a community of practice approach to

integrated STEM can also be a challenge. In addition, "the 'T and E' of STEM education appears

to be a stumbling block to producing a meaningful STEM experience to K-12 education

students" (White, 2014, p.5) which is why the overarching goals of technology and engineering

education in post-secondary schools are to produce certified technology and engineering

education teachers that are equipped with the knowledge, skills, and dispositions to be effective

educators and leaders. In practice, STEM educators lack cohesive understanding of STEM

education (Kelley and Knowles, 2016).

Beyond that, multidisciplinary teaching may sometimes be absent. Kelley and Knowles

(2016) acknowledged that:

Connecting ideas across disciplines is challenging when students have little or no

understanding of the relevant ideas in the individual disciplines. Also, students do

not always or naturally use their disciplinary knowledge in integrated contexts.

Students will thus need support to elicit the relevant scientific or mathematical

ideas in an engineering or technological design context, to connect those ideas

productively, and to reorganize their own ideas in ways that come to reflect

normative, scientific ideas and practices (as cited in NAE and NRC 2014, p. 5).

Based on this research, it would seem that educators should look for opportunities to provide instruction that applies STEM concepts in authentic, real-world situations, which undoubtedly will produce cross-curricular scenarios in the classroom.

A Conceptual Framework of STEM Education

Because of the obstacles and limitations listed previously, Kelley and Knowles (2016) proposed a conceptual framework to guide STEM educators and to build a research agenda for integrated STEM education. Much of their proposal is in line with the PLTW curriculum that this study analyzes. Their model, represented by an image of a pulley system where the pulleys are labeled Science Inquiry, Technological Literacy, Mathematical Thinking, and Engineering Design, indicates a true picture of STEM education, and also a mostly-encompassing view of PLTW curriculum.

Kelly and Knowles are not suggesting that all four domains of integrated STEM must occur during every STEM learning experience but STEM educators should have a strong understanding of the relationship that can be established across domains and by engaging a community of practice. "Foundational to this theory is the concept that understanding how knowledge and skills can be applied is as important as learning the knowledge and skills itself" (p.4), which Marzano (2007) echoes by directing instructors to develop procedural knowledge and use restructuring techniques to help students deepen understanding and generate hypotheses of new knowledge.

ENGINEERING

The engineering design process is an authentic situation in which to further student understanding of STEM concepts because of its built-in systematic method to stimulate and enhance problem-solving. The process includes an analytical element, which forces students to engage in math and science inquiry, leading to evaluation of potential design solutions, and finally the construction of a prototype based on previous research as well as trial and error. This approach creates an investigative learning environment where students construct personal knowledge based on their own educational experiences created within the framework of the engineering design process (Kelley and Knowles, 2016).

SCIENCE

Kelley and Knowles also argue that an inquiry approach to instruction requires teachers to "encourage and model the skills of scientific inquiry, as well as the curiosity, openness to new ideas, and skepticism that characterize science" (as cited in National Research Council 1996, p. 37). Science activities should not only be "hands-on," but "minds-on", and should be taught from a clearly scriptural viewpoint, recognizing that science is limited to changing theories and changing facts, unlike the enduring Word of God. Science is an effort to know and understand nature for its own sake. A discovery does not have to be practical. (Boehlke, P. R., Klockziem, R. C., & Paulsen, J. W., 1997).

TECHNOLOGY

The term technology has become almost useless because its meaning varies drastically depending on the context and individual viewpoint (White, 2014). There is an engineering view of technology and a human view of technology (Kelley and Knowles, 2016). The engineering perspective views technology as a distinct body of knowledge, and activity or way of doing. Technology then is a design or research procedure that uses a physical tool, instrument or artifact. However, the human perspective views technology as autonomous social and economic forces that often override traditional and competing values that influence the structure of the cultural/social order regardless of its user intentions. Science and technology interact. Technology can furnish tools to make more science possible, and discoveries in science can also drive new technologies.

MATHEMATICS

Williams (2007) noted that contextual teaching can give meaning to mathematics because "students want to know not only how to complete a mathematical task but also why they need to learn the mathematics in the first place" (Kelley and Knowles, 2016, p.7). Certainly, there is some STEM content that cannot be situated in authentic contexts, therefore limiting this model to only content that can be applied through situated learning approaches.

PROBLEM-BASED LEARNING

John Dewey, Jean Piaget, Lev Vygotsky and others shared a constructivist view, believing that the highest level of achievement can be expected through an experience-based,

learner-centered education that allows learners to form their own knowledge (Henson, 2003).

Falling within the parameters of that educational view, Verma, Dickerson, and McKinney state

that "Problem-based Learning (PBL) is a systematic teaching method that engages students in

learning knowledge and skills through an extended inquiry process structured around complex,

authentic questions and carefully designed products and tasks" (as cited in Jones, Ramussen, and

Moffitt, 1997).

What is PLTW?

Project Lead the Way (PLTW) is a hands-on, project-based STEM curriculum for high

school and middle school students. In 2013, enrollment in PLTW was estimated at 500,000

students (Van Overschelde, 2013). Currently, over 6,500 schools are offering nearly 7,500

PLTW programs to students in grades Kindergarten-12; this is the highest in PLTW's 17-year

history ("Project Lead the Way Continues," 2014).

Van Overschelde (2013) provides a state-specific view of the PLTW impact and growth

through his research. Annual enrollment in Texas in five years (2005-2010) had quadrupled,

including a dramatically increased diversity of students participating in the program. The study

compared data from two groups of students, originally grouped based on grade 8 math

achievement scores and demographic and program variables. One group was made up of PLTW

students, while the other group was non-PLTW students. Data was collected over a six-year

period, and the findings showed that PLTW students scored "significantly higher on the state's

Grade 11 mathematics assessment, a higher percentage met the college-ready criterion, a higher

percentage enrolled in Texas higher education institutions, and the non-college-bound PLTW students earned higher wages" (p.1).

"Integrated STEM education can create an ideal platform to blend these complementary learning theories by providing a community of practice through social discourse" (Kelley and Knowles, 2013, p.7). Project Lead the Way believes it has done just that. "The data from the study are a testament to the power of Project Lead The Way as a transformational experience for students," said PLTW President and CEO Vince Bertram (IUPUI, 2014, p.1).

Proven Effectiveness of PLTW

In general, STEM training elevates success in mathematics, science, and reading. Students also have positive views about the training, wish to see more of it in future courses, and may consider choosing STEM areas for their future careers (Soyadı, Y. A., & Tertemiz, N., 2018; Olivarez, 2012).

EFFECT ON STUDENTS

The specific STEM curriculum through PLTW produces those same benefits. Kelley (2008) investigated problem-solving behavior among a group of PLTW students and a group of students in a different program from a school which was producing a new curriculum focused on engineering design and taught by an instructor who had previous National Center for Engineering and Technology Education (NCETE) training. He discovered that PLTW students

spent significantly more time defining and analyzing a problem than the other group, but much less time generating solutions.

Tai (2012) reports that PLTW curriculum generally appeared to have a positive impact on student performance on standardized tests measuring academic achievement. Generally, PLTW students performed at or above the level of their classmates who did participate in PLTW courses. When science and mathematics achievement are examined separately, it is evident that the increase in science achievement was higher than that in mathematics (Soyadı, Y. A., & Tertemiz, N., 2018; Tai, 2014).

Tai (2012) also reported "positive outcomes with respect to self-efficacy among PLTW black students (as cited in Martin, 2011)," as well as "interest and achievement among middle school girls (as cited in Paslov, 2007)," two underrepresented demographic groups within the STEM education community (Granovskiy, 2018). Positive outcomes regarding "academic resilience among technical college transfers going on to earn baccalaureate degrees (as cited in Sielaff, 2010)" were also reported.

Furthermore, PLTW participants are nearly three times more likely to choose a college major in a STEM field, and six times more likely if they have taken at least three PLTW courses. PLTW participants are also more likely to enroll at a four-year college or university than a two-year institution and are also more likely to continue their education into the second year of college (IUPUI, 2014).

EFFECT ON TEACHERS

PLTW curriculum has not only proven to be a benefit to students. Teacher training and satisfaction also were found to be positive results of the curriculum. Ratings of PLTW professional development consistently range from valuable to very valuable. PLTW teachers increased their reporting of effective STEM integration over time, above and beyond pre-existing group differences and re-testing effects (Tai, 2014).

Daugherty (2009) states that PLTW was "among the most comprehensive programs focused on instructor training, background, and follow-up support during the school year. 94% of 247 technology educators offered a positive to strongly positive response when asked if they would recommend PLTW to others" (Tai, 2014, p.3).

EFFECT ON PRINCIPALS AND PARENTS

"Parents were generally very positive about their child's participation in the program (Werner, 2009). Principals generally believed that students are challenged and motivated, PLTW had a general positive effect on their schools, and teachers were renewed and motivated" (Tai, 2014, p.3)

In summary, Tai (2014) affirmed that "research on PLTW programs across the U.S. offers evidence that PLTW contributes to raising student achievement and motivation in science and engineering. It is a curriculum also supported by teachers, principals, and parents" (p.4).

What is the Future of STEM Education?

Granovskiy (2018) says that the question "What is the condition of STEM education in the United States?" may be unanswerable, but that there are overall trends to analyze. One trend is that degrees in fields related to science, technology, engineering, and mathematics continue to rise.

Figure 2

Number of S&E Degrees Awarded from 1966 to 2015, by Degree Level (Granovskiy, 2018)

A somewhat larger percentage of these growing degrees in STEM fields is being awarded to foreign students. "Foreign students earned 15,000 STEM doctorates at U.S. universities in 2015, up from about 8,500 in 2000. Foreign students' share of STEM doctorates rose from 30% in 2000 to 34% in 2015" (Granovskiy, 2018, p.19).

Another trend is that U.S. student performance (K-12) on standardized national

mathematics tests has held constant or improved over the past four decades, as measured by

performance on the National Assessment of Educational Progress (NAEP). Data is shown in the

graphs below.

Figure 3

Trends in 4th grade Average NAEP Mathematics Scores from 1990 to 2017 (Granovskiy, 2018)

Figure 4

Trends in 8th grade Average NAEP Mathematics Scores from 1990 to 2017 (Granovskiy, 2018)

Finally, a somewhat concerning trend is that there is a significant achievement gap (in terms of certain STEM educational outcomes) between men and women, and between various racial and ethnic groups. Women and certain racial and ethnic minorities are also significantly underrepresented in STEM majors and careers (Granovskiy, 2018).

WELS & PLTW

"WELS is a group of more than 360,000 men, women, and children in nearly 1,300 congregations across the United States and Canada united by a common faith in Christ's saving love." (wels.net). Although church membership has been steadily declining, enrollment in early

childhood ministries (ECM), elementary schools (LES), and high schools (LHS) has remained

steady.

Table 1

Lutheran School Enrollment Trends

	2013-14	2014-15	2015-16	2016-17	2017-18
ECM	10,696	10,595	10,911	10,754	11,126
LES	24,425	24,453	24,410	24,335	24,485
LHS	5,141	5,093	5,174	5,320	5,493
Prep Schools	682	675	643	645	616

From "Report to the Twelve Districts 2018"

　　　　PLTW is an effective curriculum based on the previous data. Are WELS schools taking

advantage of this curriculum? Perhaps it is not as transformational for WELS schools as the

previous studies seem to indicate. According to Tai (2014), the foremost barrier to PLTW

implementation appeared to be costs, and that may also be the case in WELS schools. Ultimately

the level of effectiveness needs to be assessed in order to judge PLTW's value in WELS schools.

Summary

　　　　The articles read for this literature review provide an excellent background of historical

development of broad STEM education in the United States as well as a more narrow view of

PLTW-specific success, growth, and benefit.

However, most of the articles focusing on STEM education offered only a very wide picture (national statistics, large public school systems, etc.); Additionally, most articles focusing on PLTW curriculum focused solely on achievement. There is still an information gap when it comes to the unique challenges within WELS schools. This survey of WELS teachers and administrators in schools that have implemented PLTW provides research data needed to fill that gap.

Chapter III: Methodology

Introduction

The literature review provided a general outlook of STEM education and PLTW curriculum. However, the majority of previous research was not specific to WELS schools, and therefore, a survey of WELS teachers who are involved with PLTW curriculum added to that body of knowledge.

This study attempted to assess how eight different aspects of WELS educational ministries (mission of the school, climate and culture, teacher satisfaction and team morale, marketing/recruitment, enrollment, test scores, school-wide curriculum, and budget) have been affected in schools which have implemented PLTW curriculum.

The goal was to seek feedback from WELS teachers who have firsthand experience with the PLTW curriculum and could offer insight about the pros and cons to each of the categories being evaluated. It was important to get feedback not only from educators who actually taught the curriculum, but also non-PLTW teachers who could offer a connected, yet "outside" view of the effect on the ministry. There were approximately 600 teachers that met this criteria, and 45.3% of those offered feedback through an electronic survey that was available from November 2019 to January 2020.

Research Questions

Survey results and research were used to answer the following research questions:

1. To what extent has the <u>mission of the school</u> been affected in schools that have implemented PLTW curriculum?

2. To what extent has the <u>school climate and culture</u> been affected in schools that have implemented PLTW curriculum?

3. To what extent has <u>teacher satisfaction and team morale</u> been affected in schools that have implemented PLTW curriculum?

4. To what extent has <u>marketing/recruitment</u> been affected in schools that have implemented PLTW curriculum?

5. To what extent has <u>enrollment</u> been affected in schools that have implemented PLTW curriculum?

6. To what extent have <u>standardized test scores</u> been affected in schools that have implemented PLTW curriculum?

7. To what extent has the <u>school-wide curriculum</u> been affected in schools that have implemented PLTW curriculum?

8. To what extent has the <u>school (or overall ministry) budget</u> been affected in schools that have implemented PLTW curriculum?

Research Design and Procedures

The researcher first requested a list of all 25 WELS high schools and 313 WELS elementary schools from the WELS Commission on Lutheran Schools (CLS). By using the PLTW school locator webpage, that list was cross-referenced and narrowed down to identify only the schools that have implemented PLTW curriculum. This process uncovered a total of 18 elementary school campuses, 7 high school campuses, and 2 campuses that had both elementary and high school.

Because of the relatively small number of schools and teachers that made up the study, the researcher personally contacted all administrators of each school by phone to communicate the purpose of the project, ask for permission to contact faculty members at those schools, to request a list of emails, to encourage participation, and to request they promote participation with their faculty in hopes of providing more robust and reliable data.

Email lists were provided by 22 of the schools. Five administrators preferred that the researcher send the survey request email directly to them to forward on to their faculty. The administrator of one school did not respond, but email addresses for faculty members were obtained through their website.

The survey request was emailed to all teachers of those schools between January 1 and January 6 of 2020. A follow-up email was sent on January 15. The survey was closed on January 17 at 11:59 p.m.

Population and Sample

The subjects of this study were Kindergarten-12th grade teachers and administrators in WELS schools. There are currently 2,377 WELS preschool-12 teachers. However, many of these teachers did not fit the parameters for the study, since only teachers in schools where the PLTW curriculum has been implemented were being considered. Based on this constraint, the total number of possible subjects was 600, to whom the survey was sent. Of those, 272 subjects completed the survey, a response rate of 45.3%. It should be noted that, in spite of the researcher's attempt to explain the target audience for the survey, a small portion (5.9%) of the survey results came from others outside of this scope. This happened because some provided email lists included non-teaching faculty.

Given the demographics of WELS Schools and WELS teachers, there were certain expected characteristics of these teachers that were verified through the survey: Some respondents were male (55.9%) and others were female (44.1%), they served in a mixture of teaching locations, and were mainly caucasian (98.9%).

Figure 5

Type of Respondent

There were three different sub-groups that provided data: 1. Administrators; 2. PLTW teachers that have first-hand experience teaching the PLTW curriculum (currently or in the past); and 3. Non-PLTW teachers in schools where the curriculum is being taught by others.

Instrumentation

This study was conducted using a survey created in Google Forms which gathered both qualitative and quantitative data. The survey questions were adjusted slightly for the three different subject groups. The content of the online survey questions can be found in Appendix A. The survey was emailed to all Kindergarten-12th teachers and administrators that had been identified.

Data Analysis Procedures

After the surveys were completed and the information was collected, the results were analyzed as follows.

Non-mandatory qualitative data was coded and grouped according to themes that surfaced from the data gathered. This analysis and grouping was done through the same process for each category. The researcher read all responses as a group to get a general sense of the feedback. The researcher then reread the responses one at a time, and created a word or phrase

(the theme) that encapsulated the essence of the statement that was made. This qualitative data, separated by research question, can be seen in the appendices.

Quantitative data was organized in graphs/charts by using Google Forms "Show Summary of Responses" data analysis. In order to analyze cross-sectional trends within the subgroups, Google Sheets was used to regroup such data and produce similar charts.

Limitations

A few methodological limitations and procedural weaknesses were evident during and after the survey. First, communication regarding the specific intent of the type of respondents should have been clarified. Some people thought that the survey was only for PLTW teachers, even though it was for any teacher that taught at a PLTW school.

Secondly, the researcher received email lists from principals, but some lists included preschool teachers, mission advancement staff, or other personnel. Although some of these people had knowledge of the PLTW curriculum and the impact on their school, many did not and answered with many "neutral" responses.

Finally, some of the open-ended survey questions regarding insights or other factors for certain categories may have been too vague. Although these questions provided benefit in allowing the researcher to find themes within the group of responses, those themes were subjective, and some respondents did not seem to directly answer the question.

Summary

A survey was used to collect data to determine how PLTW curriculum affected WELS schools in the areas of mission, climate and culture, teacher satisfaction and team morale, marketing/recruitment, enrollment, test scores, school-wide curriculum, and budget. Schools that make use of the PLTW curriculum were identified, and the teachers within those schools became the subjects of the study. An electronic survey was sent via email either directly from the researcher or by administrators of the school who were asked to send it on behalf of the researcher. 272 of the possible 600 respondents provided feedback.

Chapter IV: Results

Introduction

For each of the eight aspects of WELS educational ministries, the survey responses provided advantages and disadvantages based on the feedback of educators who have firsthand experience with the PLTW curriculum. These results do not give a definitive answer about whether or not PLTW should be implemented in all WELS schools, or even at a particular school. However, they do provide guidance for those considering PLTW implementation. God willing, this data will be a blessing to those who are considering adding the PLTW curriculum as part of their course offering so they can make a wise decision that is best for their ministry.

Data Analysis

1. To what extent has the <u>mission of the school</u> been affected in schools that have implemented PLTW curriculum?

   One respondent stated that "meeting the mission of the school is very high level when the particular instructional resource a school uses shouldn't have a major impact in changing the school's ability to meet mission." However, only 34.2% of respondents shared this view by marking that no change in ability to meet mission was evident.

   Instead, the majority of respondents believed that PLTW did in fact allow them to better meet their mission, with 25% indicating it provided a major positive impact, and another 39.3% indicating it provided a minor positive impact.

Figure 6

Levels of Perceived Impact of PLTW Curriculum on Mission

Themes in the qualitative data (Appendix D) may provide a deeper understanding of

these results. There were a total of 72 non-mandatory qualitative responses, some of which

encompassed more than one theme. Three major themes emerged and were categorized in the

following way.

Table 2

Qualitative Data Themes - Mission: Insights

Please share any other insight regarding mission of the school that might be beneficial to this study:		
Category	**Theme**	**Number of Comments**
G	**Growth through marketing/recruitment (especially of non-WELS)**	**16**
P	**Preparation for service in this world**	**14**
E	**Excellence**	**10**
A	*Additional Insights (not enough to be a theme)*	*5*
N	*Not applicable to developing a theme*	*29*

The first theme ties the ability to meet the mission of the school with that of marketing and enrollment growth, especially of non-WELS students. By allowing schools to market themselves in a way they couldn't previously, there is a potential to minister to more students. "They may come here for STEM, but they also get the gospel and Christ-centered education."

A second qualitative theme was that of preparation for Christian service in this world. Much like participation in fine arts, practical arts, and athletics, PLTW teaching/learning adds an additional valuable component to produce well-rounded students. Professional characteristics such as communication, collaboration, creativity, critical thinking, grit, and ethics are essential to becoming productive members of society. These characteristics, which are important regardless of the career path a student chooses, are a focus of the PLTW curriculum. From the data analysis, students may be in a better position to develop these skills within a PLTW classroom, and can someday bring their Christian faith into a workplace that has a large impact on society.

Finally, the third qualitative theme is that of excellence. Data driven best practices coupled with perceptions among school parents about what quality education should be, drive WELS schools - at least in part - to operate with a high level of excellence. The goal is to break down any barriers so that the gospel can be shared to the maximum extent.

It should be noted that when the data was analyzed in greater detail (Appendix E) to highlight trends between respondent types (PLTW teachers, non-PLTW teachers, principals, grade school, high school), there was no significant deviation from the overall data shown in Figure 6.

Although both the quantitative and qualitative data show a strong support of PLTW's effect on the ability for schools to meet their mission, there were also a few concerns voiced in the qualitative data. These include the curriculum potentially being too rigorous for underachieving students or simply becoming too overwhelming to fit in with all the other programs, and a potential over-dependence on the PLTW materials which could be eliminated.

Beyond these words of caution, it is important to note that correlation does not necessarily imply causation. While most respondents noted a positive impact on the ability to meet the school's mission, qualitative data suggested that other programs/classes, practices of excellence and/or professionalism, outreach, staffing changes, improved facilities, school leadership, voucher programs, and Christian environment could be other factors that also play a role in a school's ability to meet their mission.

Table 3

Qualitative Data Themes - Mission: Other Factors

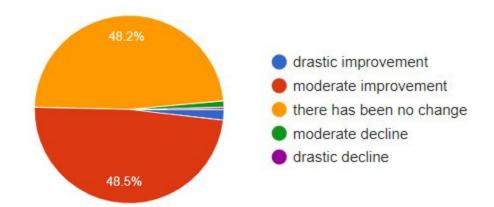| If there has been a change in the school's ability to meet its mission, what other factors besides PLTW implementation may have caused this?		
Category	**Theme**	**Number of Comments**
P	**Programs/Classes**	15
E	**Excellence / Professional practices**	15
O	**Outreach / Recruitment / Enrollment**	11
S	**Staffing**	10
F	**Facilities**	10
L	**Leadership**	9
V	**Voucher program**	9
C	**Christian environment**	5
N	*Not applicable*	*21*

2. To what extent has the <u>school climate and culture</u> been affected in schools that have

    implemented PLTW curriculum?

    WELS educators understand that Christ-centered education has a greater positive impact

on culture than any curriculum ever could. But does implementation of PLTW curriculum

influence climate and culture at all, either positively or negatively?

    Almost half of the respondents said that no climate/culture change had taken place, while

the other half indicated a moderate improvement of school climate and culture was noticeable

since the implementation of PLTW curriculum at their school.

Figure 7

Levels of Perceived Impact of PLTW Curriculum on School Climate and Culture

    When analyzing the qualitative data (Appendix F), the strongest theme that could

potentially account for a positive impact on climate and culture is that students learned "soft"

skills (and others) through a unique hands-on style of instruction that PLTW courses provide.

This creates engagement and builds excitement as students can envision the real-world

connection to industry.

Student pride in work and inclusion of more students are lesser themes that may justify a minor positive shift in school climate and culture. Because of the nature of PLTW courses, there are often more opportunities to showcase student work, which students can be proud of, knowing they have succeeded and/or excelled in rigorous coursework. Beyond that, PLTW can engage students who do not usually participate in other extracurricular activities, giving them a stronger sense of purpose.

Again, it should be noted that the when the data was analyzed in greater detail (Appendix G) to highlight trends between respondent types (PLTW teachers, non-PLTW teachers, principals, grade school, high school), there was no significant deviation from the overall data shown in Figure 7.

Beyond the themes that capture the possible rationale for a minor climate/culture improvement, there was also an additional theme that provided a word of warning. The qualitative feedback suggested that students and/or teachers could feel overloaded when implementing PLTW. Instructors may be asked to teach extra courses, and students may not have room in their schedules to adequately handle the rigor of PLTW courses and simultaneously participate in other course offerings. Ultimately, this could contribute to a deterioration of school climate and culture.
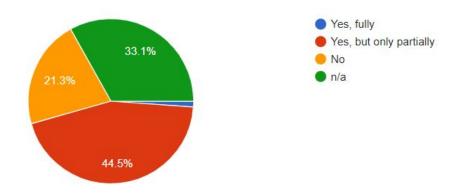
Table 4

Qualitative Data Themes - Climate/Culture: Insights

Please share any other insight regarding school climate and culture that might be beneficial to this study:		
Category Label	**Theme**	**Number of Comments**
S	**Skills learned through style of instruction with high expectations**	9
P	**Pride**	3
I	**Inclusion of more students**	3
O	**Overload**	3
A	*Additional Insights (not enough to be a theme)*	4
N	*Not applicable to developing a theme*	18

If there is a positive impact on school climate and culture due to PLTW implementation,

only 1.8% of respondents were willing to attribute the credit solely to the STEM curriculum.

Figure 8

Levels of Perceived PLTW Credit for Impact on School Climate and Culture

This may seem rational, since school climate and culture is rarely defined by a single

factor. 44.5% of respondents indicated that PLTW was indeed responsible for a change in

climate and culture, but only in part. Three major themes emerged from the qualitative data,

indicating that teacher-focused encouragement, school leadership, and specific programs and/or

other programs or course offerings were also major factors influencing school climate and

culture.

Table 5

Qualitative Data Themes - Climate/Culture: Other Factors

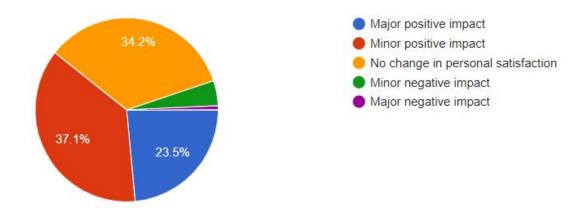| If there has been a change in the school's ability to meet its mission, what other factors besides PLTW implementation may have caused this?		
Category Label	Theme	Number of Comments
T	T - Teacher interaction and encouragement	21
L	L - Leadership / Leadership changes	20
P	P - Other programs and curriculum	19
D	D - Change in demographics	7
A	A- Activities / Group discussions	5
Q	Q - Assessment	4
M	M - Consistent / Heightened discipline	4
C	C - Focus on Christian motivation / Core values	3
O	*Additional Insights (not enough to be a theme)*	5
N	*Not applicable*	22

3. To what extent has <u>teacher satisfaction and team morale</u> been affected in schools that

   have implemented PLTW curriculum?

   The majority of respondents (60.6%) reported that PLTW created a positive impact

(37.1% minor; 34.2% major) on their satisfaction as a teacher or administrator. Another 34.2%

cited no change in personal satisfaction, and 5.1% reported a negative impact (4.4% minor; 0.7% major).
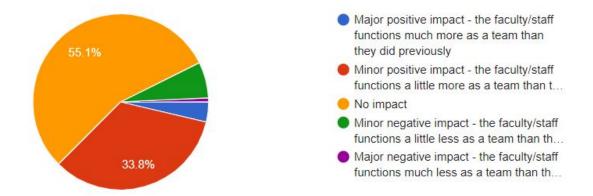
Figure 9

Levels of Perceived Impact of PLTW Curriculum on Teacher Satisfaction

Although teacher satisfaction had a noticeable positive correlation, team morale was not as significant. More respondents reported a positive impact (37.5%) than did negative (7.3%). However, the majority of respondents (55.1%) cited that no change in team morale was evident.

Figure 10

Levels of Perceived Impact of PLTW Curriculum on Team Morale

The cross-sectional data (Appendix I) highlighted some deviation from the overall

quantitative data when focusing on certain sub-groups. When reporting on both teacher

satisfaction and team morale, PLTW teachers were more likely to report a positive perceived

level of impact than non-PLTW teachers. When reporting on both teacher satisfaction and team

morale, grade school teachers were more likely to report a positive perceived level of impact

than high school teachers.

Themes from the analysis of qualitative data (Appendix H) give a clearer picture of the

quantitative data. The first was that of teachers being able to recognize and celebrate student

enjoyment and success in the classroom due to the implementation of PLTW curriculum. These

comments were all positive.

The second theme had a mixture of positive and negative comments that communicated

an appreciation for a new style of instructional methodology, an acknowledgement of the

benefits and challenges of a rigorous curriculum, and a forced shift in educational philosophy.

All of these items play a role in a teacher's satisfaction.

Although it was not as predominant as the others, the third theme was that of team/group

collaboration. These comments indicated that the PLTW curriculum provided more opportunities

for teachers to collaboratively plan instruction.

Table 6

Qualitative Data Themes - Teacher Satisfaction / Team Morale: Insights

If there has been a significant change in teacher satisfaction and/or team morale, what other factors besides PLTW implementation may have caused this?		
Category Label	**Theme**	**Number of Comments**
E	E - Student enjoyment/success drives teacher satisfaction	12
I	I - Instructional methodology, curriculum, and/or educational philosophy	10
T	T - Team collaboration	7
C	C - Competition over students (scheduling)	6
O	O - "Old" traditional courses vs. "new" PLTW	5
W	W - Workload increased and/or staffing needs	5
Z	Z - Communication	4
F	F - Frustration with how curriculum is written and/or presented	3
A	*A - Additional Insights (not enough to be a theme)*	*6*
N	*N - Not applicable to developing a theme*	*16*

Does this mean that implementation of PLTW curriculum produces a higher satisfaction

in teachers/administrators and builds team morale? Not necessarily. Again, it should be noted

that correlation does not necessarily indicate causation. The qualitative data unveiled many other

minor themes that could potentially affect satisfaction and team morale. In addition to those, respondents also provided possible factors besides PLTW that may play a role. The three strongest themes from this feedback were staffing/administrative changes/needs, relationships (and the personalities/mindset that come with them), as well as a focus on curriculum. As one respondent noted, with many potential factors, "it is hard to credit PLTW with an accurate proportion."

Table 7

Qualitative Data Themes - Teacher Satisfaction / Team Morale: Other Factors

If there has been a significant change in teacher satisfaction and/or team morale, what other factors besides PLTW implementation may have caused this?		
Category Label	**Theme**	**Number of Comments**
S	**S - Staffing and/or administrative changes and/or needs**	17
R	**R - Relationships / Personalities / Mindset**	10
C	**C - Curriculum focus**	9
W	**W - Workload (driven by scheduling)**	4
G	**G - God's Word**	3
F	**F - Funding**	3
B	**B - Building**	3
O	**O - Other programs**	3
A	*Additional Insights (not enough to be a theme)*	*3*
N	*Not applicable to developing a theme*	*11*

4. To what extent has <u>marketing/recruitment</u> been affected in schools that have

   implemented PLTW curriculum?

   Marketing and recruitment is meant to attract and engage potential students, which

undoubtedly is based on presenting them with beneficial aspects of what a school has to offer.

The analysis of this category was meant to determine if the implementation of PLTW was an

asset or deterrent in the marketing/recruitment strategies of WELS schools.

   Because many teachers are not involved in the marketing/recruitment efforts of their

school, this portion of the survey was reserved for administrators, yielding 30 responses.
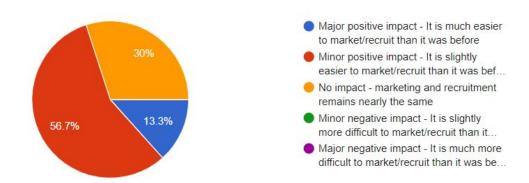
Although the sample size was relatively small, the responses were overwhelmingly positive in

administrators' perceived impact of PLTW on recruitment/marketing. 70% of respondents listed

a positive impact (13.3% major; 56.7% minor), while the other 30% cited no impact because of

PLTW. No respondents listed any negative impact to their marketing/recruitment efforts.

Figure 11

Levels of Perceived Impact of PLTW Curriculum on Marketing/Recruitment

To what extent has marketing & recruitment been affected in schools that have implemented PLTW curriculum?

30 responses

Cross-referenced data (Appendix K) revealed that high school administrators reported a higher level of positive influence on marketing and recruitment than grade school administrators. Because of the low number of respondents for this category of analysis, qualitative data was limited in developing insightful themes for further interpretation. However, a full list of qualitative responses can be found in Appendix J.

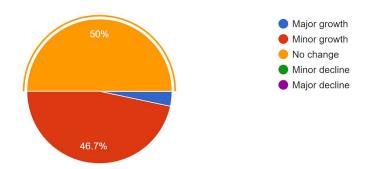5. To what extent has <u>enrollment</u> been affected in schools that have implemented PLTW curriculum?

Analysis of the marketing/recruitment category indicated a positive correlation with PLTW implementation. But does that ultimately drive enrollment trends in a positive direction? Again, this was a group of survey questions that was reserved for administrators, who typically have a better understanding of historical enrollment trends than the average teacher. Half of the respondents indicated that no change in enrollment trends was recognized, while the other half listed growth, mainly minor growth (46.7%).

Figure 12

Levels of Perceived Impact of PLTW Curriculum on Enrollment Trends

Compared to previous enrollment trends, to what extent has enrollment been affected since the implementation of PLTW at your school?
30 responses

- Major growth
- Minor growth
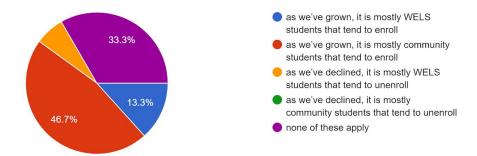- No change
- Minor decline
- Major decline

Responses to a follow-up question revealed that for schools experiencing growth, it was mostly community students that were enrolling; and for schools that were continuing to decline (6.7% of respondents), it was mostly WELS students that unenrolled.

Figure 13

Type of Enrollment Growth or Decline

If there has been a significant change in enrollment, what is the make-up of your school as you grow or decline? (check any that apply)
30 responses

- as we've grown, it is mostly WELS students that tend to enroll
- as we've grown, it is mostly community students that tend to enroll
- as we've declined, it is mostly WELS students that tend to unenroll
- as we've declined, it is mostly community students that tend to unenroll
- none of these apply

Cross-sectional data (Appendix M) shows that high school administrators reported more growth than grade school administrators. However, that growth is minor.

The fairly limited amount of qualitative data (Appendix L) does not provide any clear themes to further analyze the quantitative data, but does suggest that there are many other aspects of a school ministry beyond PLTW implementation that factor into enrollment.

6. To what extent have <u>standardized test scores</u> been affected in schools that have implemented PLTW curriculum?

Based on the quantitative data provided by 30 administrators, math standardized tests, science standardized tests, and reading standardized tests all showed some growth, with only 1 respondent indicating a decline. When comparing the three subjects, math had a higher level of growth than science or reading, which echoes the data found in the literature study.

However, with a fairly small sample size that is accentuated by a moderate number of respondents choosing "n/a" or "no change" for each question, the results may not be fully reliable. Even the qualitative date (Appendix N) and cross-sectional data (Appendix O) is extremely limited in providing additional insight.

Figure 14

Growth or Decline of Math Standardized Test Scores

To what extent have math standardized test scores been affected since the implementation of PLTW at your school?
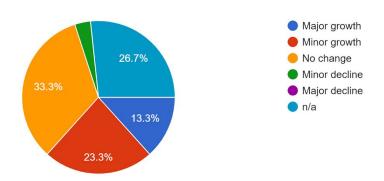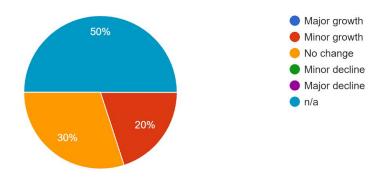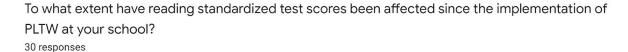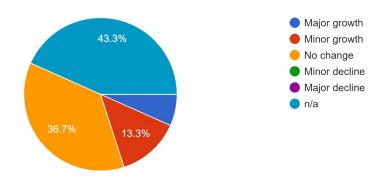
30 responses

Legend:
- Major growth
- Minor growth
- No change
- Minor decline
- Major decline
- n/a

Values shown: 26.7%, 33.3%, 13.3%, 23.3%

Figure 15

Growth or Decline of Science Standardized Test Scores

To what extent have science standardized test scores been affected since the implementation of PLTW at your school?

30 responses

Legend:
- Major growth
- Minor growth
- No change
- Minor decline
- Major decline
- n/a

Values shown: 50%, 30%, 20%

Figure 16

Growth or Decline of Reading Standardized Test Scores

To what extent have reading standardized test scores been affected since the implementation of PLTW at your school?

30 responses

Although the survey responses regarding PLTW's effect on standardized tests scores were a bit ambiguous, one specific case study was provided through guidance from Mike Koestler, principal of Shoreland Lutheran High School. This case study pulled MAP testing mathematics data from two groups of Shoreland Lutheran 9th and 10th grade students in the 2018-19 school year. Group A was composed of students in the STEM Engineering courses, Introduction to Engineering Design and Principles of Engineering. Group B was composed of all other 9th and 10th grade students.

The difference in growth and achievement was significant. When measuring the percentage of projected growth, 100% is the normal (baseline) level, meaning that a full year's worth of growth is expected. Group A (PLTW students) had a projected growth of 420%, meaning that they showed mathematical academic growth over four times higher than the

average. Group B (non-PLTW students) had a projected growth rate of 261%. This is also

above-average growth, but still significantly lower than their PLTW counterparts.

Growth levels combined with achievement levels can also be seen together in the figures

below. As expected, the non-PLTW students (Group B) have a quadrant chart that is fairly

evenly distributed. However, the quadrant chart from the PLTW Engineering students (Group A)

is obviously trending toward the "High Achievement / High Growth" quadrant.

Figure 17

2018-19 Achievement Status & Growth Summary with Quadrant Chart
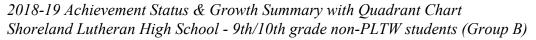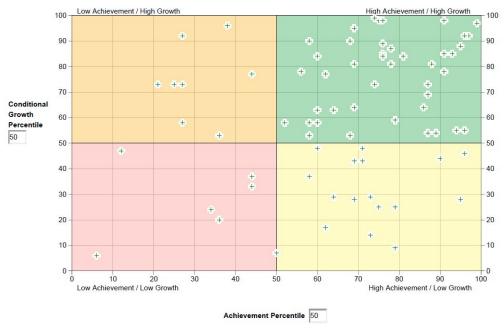*Shoreland Lutheran High School - 9th/10th grade PLTW Engineering students (Group A)*

Figure 18

2018-19 Achievement Status & Growth Summary with Quadrant Chart
Shoreland Lutheran High School - 9th/10th grade non-PLTW students (Group B)

This case study may provide more support to the limited mathematical data obtained

from the survey.

7. To what extent has the school-wide curriculum been affected in schools that have
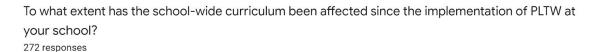
   implemented PLTW curriculum?

   WELS schools have implemented PLTW in a variety of ways. In some cases, it has taken

the place of a science curriculum. In other cases, it is simply an addition to the current

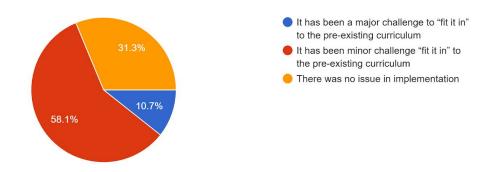curriculum. In some high schools, it is purely an elective.

   In general, regardless of the educational setting, there has been at least a minor struggle

to fit PLTW into the pre-existing curriculum. Most respondents (58.1%) cited implementation as

a minor challenge. However, another 10.7% saw this as a major challenge. Less than a third of

respondents (31.3%) indicated there was no issue of "fitting in PLTW" into the pre-existing

curriculum.

Figure 19

Levels of Perceived Impact of PLTW Curriculum on School-Wide Curriculum

To what extent has the school-wide curriculum been affected since the implementation of PLTW at your school?
272 responses

The cross-sectional data analysis (Appendix Q) indicated that PLTW teachers viewed

implementation of PLTW curriculum to be more difficult than other respondents. Furthermore,

administrators were the largest contributors to the "major challenge" category.

In general, most respondents agreed there was some level of difficulty, but most also did

not see it as a major difficulty. Clarifying this, the most prevalent theme from the qualitative data

(Appendix P) was that of scheduling. One respondent claimed, "The PLTW courses are electives

which means kids have to sometimes make choices between taking PLTW courses and other

disciplines such as art and music." In a self-contained grade school setting, time to finish PLTW

projects (which are often dependent on certain materials) can create a challenge for teachers as

they attempt to avoid neglect of other subjects in their daily schedule. Beyond that, there were

other less prevalent themes such as teacher availability (which may also stem from scheduling

issues) and potential gaps in the curriculum when PLTW replaces a science curriculum.

Table 8

Qualitative Data Themes - School-wide Curriculum: Insights

Please share any other insight regarding school-wide curriculum that might be beneficial to this study:		
Category Label	Theme	Number of Comments
S	S - Scheduling (and lack of options) / Balance of courses / Time	18
T	T - Teacher availability lacking	4
G	G - Gaps in traditional curriculum because of PLTW	4
H	H - Determine HOW it fits before implementing	3
I	I - Influence teaching in other areas	3
M	M - Materials	3
A	*Additional Insights (not enough to be a theme)*	*9*
N	*Not applicable to developing a theme*	*16*

As we've seen in other areas of this study, there are other factors that could have

potentially contributed to significant changes to school-wide curriculum. Most notably were new

or updated courses/curriculum such as AP courses, some which also led to scheduling
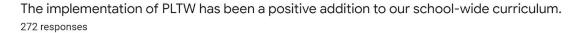
challenges.

Table 9

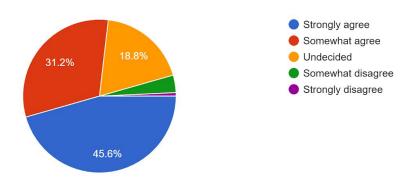*Qualitative Data Themes - School-wide Curriculum: Other Factors*

If there has been a significant change in school-wide curriculum, what other factors besides PLTW implementation may have caused this?		
Category Label	Theme	Number of Comments
U	U - Updated or New curriculum in other areas	14
S	S - Scheduling because of increase in course offerings	10
P	P - Advanced Placement Courses	7
D	D - Departmentalization and/or different structure	4
F	F - Facilities and equipment	3
E	E - Enrollment changes	2
A	*Additional Insights (not enough to be a theme)*	7
N	*Not applicable to developing a theme*	11

Regardless of the varied perceived levels of difficulty to implement, most respondents agreed that PLTW has been a positive addition to the school-wide curriculum (31.2% somewhat agree, another 45.6% strongly agree). Some (18.8%) were undecided, while only 4.4% disagreed. Cross-sectional data analysis (Appendix Q) showed that non-PLTW teachers were noticeably more critical of PLTW's impact to their school's curriculum; however, 71% of them still saw it as a positive addition (only 7% viewed it as a negative).

Figure 20

Levels of Perceived Benefit of PLTW Curriculum on School-Wide Curriculum

The implementation of PLTW has been a positive addition to our school-wide curriculum.
272 responses

Strongly agree
Somewhat agree
Undecided
Somewhat disagree
Strongly disagree

31.2% 18.8% 45.6%

8. To what extent has the school (or overall ministry) budget been affected in schools that
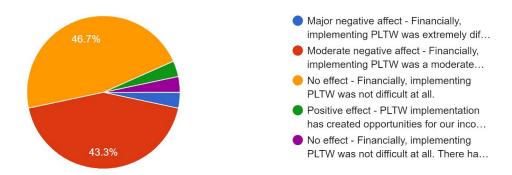   have implemented PLTW curriculum?

Of the 30 administrators that responded about PLTW's effect on the budget, most (28

respondents) fell into one of two categories: Either they said that PLTW implementation had no

effect on the budget (50%), or that it had a moderate negative effect on the budget (43.3%).

Qualitative responses (Appendix R) and cross-sectional data analysis (Appendix S) were limited

and did not offer much further insight.

Figure 21

Levels of Perceived Impact of PLTW Curriculum on Budget

To what extent has the school (or overall ministry) budget been affected in schools that have implemented PLTW curriculum?
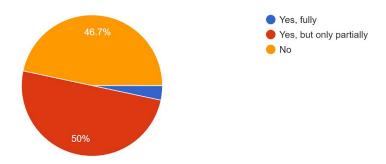
30 responses

- Major negative affect - Financially, implementing PLTW was extremely dif…
- Moderate negative affect - Financially, implementing PLTW was a moderate…
- No effect - Financially, implementing PLTW was not difficult at all.
- Positive effect - PLTW implementation has created opportunities for our inco…
- No effect - Financially, implementing PLTW was not difficult at all. There ha…

The majority (53.3%) of respondents felt that PLTW was a factor in a change to the

school budget, but most felt it was only partly responsible for such a change.

Figure 22

Credit Given to PLTW Curriculum for Impacting Budget

If there has been a change in school budget, do you feel it is because of PLTW implementation?

30 responses

- Yes, fully
- Yes, but only partially
- No

Finally, the majority of administrators (83.3%) reported that they had received outside-the-budget funding in order to implement the PLTW curriculum (40% receive minor assistance, while 43.3% received major assistance).

Figure 23

Levels of Outside-the-Budget Funding of PLTW Curriculum

Were you able to obtain outside-the-budget funding (donations, grants, etc) in order to help defer the cost of PLTW implementation?
30 responses

- No
- Yes, minor assistance
- Yes, major assistance

Summary

Past research shows that PLTW curriculum can have a positive effect on academic achievement. This new data regarding WELS schools, found through this research survey, indicates there is, in general, a positive correlation between PLTW implementation and all 8 categories that were evaluated in the survey:

WELS schools have a unique mission of sharing the truth of Scripture with their students. The majority of respondents (64.3%) stated that implementation of PLTW has a positive impact on the mission of their school.

Establishing a positive climate and culture within a school is beneficial to both teachers and students. 50% of respondents stated that implementation of PLTW has a positive impact on their school's culture and climate.

Teacher satisfaction and team morale go hand-in-hand with culture and climate. Satisfied teachers generally means better school climate/culture. The majority of respondents (60.6%) stated that implementation of PLTW had a positive impact on their satisfaction as a teacher or administrator. Most (55.1%) agreed that implementation did not affect team morale.

Marketing/recruitment is an important focus of many WELS schools, a strategic attempt to bring in a higher enrollment so that God's Word can be shared with more children. The majority of respondents (70%) stated that implementation of PLTW has a positive impact on marketing/recruitment, although a lesser amount (50%) reported a positive impact on enrollment.

Standardized test scores have served to show students' norm-based academic achievement levels. A fairly low amount of respondents reported that implementation of PLTW has a positive impact on standardized test scores (36.6% in math; 20% in science; 20% in reading). It should be stated that many of the respondents simply did not have data to adequately give a response in this survey category. However, one case study provided by a respondent of the survey does indicate a strong positive correlation between PLTW's engineering courses and standardized math growth.

Teachers often spend an extensive amount of time on fine-tuning their curriculum. The majority of respondents (68.8%) stated that implementation of PLTW was a challenge to fit into the pre-existing curriculum. And yet, the majority of respondents (76.8%) stated that PLTW was a positive addition to their school-wide curriculum.

Professional development, curriculum upgrades, campus enhancements, and materials can all benefit a student's educational experience. However, they require planned funding in order to make them a reality. 50% of respondents stated that implementation of PLTW was not a financial burden, although another 46.6% did state a negative effect. At the same time, 83.3% of respondents obtained outside-the-budget funding for the sake of implementation.

When looking at the data as a whole, two other items are important to keep in mind. First, in most categories where PLTW's implementation can not be viewed as a significantly positive correlation (specifically climate/culture and enrolment categories), it should be noted that the other portion of the respondents were mostly neutral, not indicating a negative impact. Secondly, as stated previously, correlation does not mean causation. Therefore, implementing PLTW does not necessarily mean that marketing, enrollment, teacher satisfaction, etc. will improve.

Chapter V: Summary, Conclusions, and Recommendations

Introduction

In this research study, the effect of PLTW curriculum on WELS schools has been studied, specifically analyzing 8 different categories: effect on mission, climate and culture, teacher satisfaction and team morale, marketing/recruitment, enrollment, test scores, school-wide curriculum, and budget.

WELS schools that make use of the PLTW curriculum were identified, and the teachers within those schools were asked to complete a survey that was used to collect data. Of the possible 600 respondents, 272 provided feedback. Some of the results were in line with previous research, while other results produced new information specific to WELS schools.

Summary of the Results

WELS schools have a unique mission of sharing the truth of Scripture with their students, giving deeper meaning to the other subjects that are taught. Administrators of these schools strive to establish a positive climate and culture, as well as teacher satisfaction and team morale, understanding the benefits to both teachers and students. Higher enrollment means a larger school family in which to share God's Word, which is why marketing/recruitment has become a higher priority for many schools in recent years. Standardized tests have been and will continue to be a part of our educational system, providing a reflection of curriculum implementation, an area of high focus for many teachers. Nearly all these items come at a cost, and to be good

stewards of the ministry that God has provided, school leaders must recognize a variety of impacts to the ministry budget. New data found through this research study, indicates that there is, in general, a positive correlation between PLTW implementation and most of the categories.

The majority of respondents (64.3%) stated that implementation of PLTW has a positive impact on the mission of their school. 50% of respondents stated that implementation of PLTW has a positive impact on their school's culture and climate. The majority of respondents (60.6%) stated that implementation of PLTW has a positive impact on teacher satisfaction, although most (55.1%) agreed that implementation didn't affect team morale. The majority of respondents (70%) stated that implementation of PLTW has a positive impact on marketing/recruitment, although a lesser amount (50%) viewed it as a positive impact on enrollment. A small number of respondents reported implementation of PLTW has a positive impact on standardized test scores (36.6% in math; 20% in science; 20% in reading), although many of the respondents simply did not have data to adequately give a response in this survey category.

The majority of respondents (68.8%) stated that implementation of PLTW was a challenge to fit into the pre-existing curriculum. And yet, the majority of respondents (76.8%) stated that PLTW was a positive addition to their school-wide curriculum. 50% of respondents stated that implementation of PLTW was not a financial burden, although another 46.6% did state a negative effect. At the same time, 83.3% of respondents obtained outside-the-budget funding for the sake of implementation.

Conclusions

Survey results and research were used to answer the following research questions:

1. To what extent has the <u>mission of the school</u> been affected in schools that have
   implemented PLTW curriculum?

2. To what extent has the <u>school climate and culture</u> been affected in schools that have
   implemented PLTW curriculum?

3. To what extent has <u>teacher satisfaction and team morale</u> been affected in schools that
   have implemented PLTW curriculum?

4. To what extent has <u>marketing/recruitment</u> been affected in schools that have
   implemented PLTW curriculum?

5. To what extent has <u>enrollment</u> been affected in schools that have implemented PLTW
   curriculum?

6. To what extent have <u>standardized test scores</u> been affected in schools that have
   implemented PLTW curriculum?

7. To what extent has the <u>school-wide curriculum</u> been affected in schools that have
   implemented PLTW curriculum?

8. To what extent has the <u>school (or overall ministry) budget</u> been affected in schools that
   have implemented PLTW curriculum?

Educators in WELS schools that used PLTW were surveyed to provide both quantitative
and qualitative feedback. Results generally showed that PLTW curriculum has a positive

correlation to the eight categories of ministry that were analyzed. Survey feedback also provided

potential challenges of implementation.

Recommendations

The following recommendations are proposed in regards to PLTW implementation in

WELS schools: (1) WELS school leaders should explore PLTW implementation, (2) For school

leaders that wish to pursue PLTW implementation, they ought to identify and plan for obstacles

based on research, and (3) WELS should adequately prepare future PLTW instructors for

teaching in WELS schools.

WELS School Leaders Should Explore Implementation

WELS schools have a unique privilege and mission to share the words of Scripture to the

students that God has placed in their care. They also have the honor of instructing students about

the many different intricacies of God's creation through subjects such as math, reading, science,

social studies, physical education, and the like. As ambassadors of God, school leaders strive to

do everything with a high level of excellence.

The literature review contained in this study shows that STEM education is more than

just a fad; it's here to stay. Past research has shown that PLTW curriculum leads to positive

academic achievement, and new data found in this research survey shows that PLTW

implementation WELS schools can be positive on multiple levels, most notably helping schools

meet their mission.

As of October 2019, only 9 of 28 WELS high schools (32%) and only 22 of 312 WELS elementary schools (7%) have implemented the Project Lead the Way (PLTW) curriculum. For that majority of WELS schools that have not, discussion about potential PLTW implementation would be warranted. It would be worth exploring and identifying the potential challenges, benefits, and feasibility (looking beyond the initial price tag of implementation). Visiting WELS schools that have implemented PLTW (Appendix C) may be a wise first step.

Identify and Plan for Obstacles Based on Research

After further research, if WELS school leaders decide that it is beneficial to implement PLTW, they ought to keep in mind the findings from this study to decrease any obstacles of transition. Further general feedback (Appendix T) may also be useful.

First, schools must continue to monitor if PLTW (or any other curriculum) is truly helping their ministry meet its mission; if not, abandon it. Secondly, research possible outside-the-budget funding for initial and/or ongoing implementation. Administrators of schools who are currently using the curriculum may be able to provide guidance in this area. Thirdly, school leaders should expect scheduling to be a challenge. They should clarify these challenges before implementation, and communicate them adequately to their entire teaching staff.

Beyond that, schools must determine exactly how PLTW will fit into their curriculum. Is it a replacement or an enhancement? School leaders ought to be able to communicate this plan with all stakeholders and also recognize that although only a few instructors will teach the PLTW classes, it will affect all teachers. Finally, make a plan to use PLTW as a marketing tool.

Teacher testimonials, student testimonials, and data of how PLTW affects standardized test scores may be used to promote the ministry both internally and externally.

Prepare Future PLTW Instructors for Teaching in WELS Schools

Given the continued national push for STEM teaching, continued national growth and recognition of PLTW, and the established benefit of PLTW curriculum in WELS schools, it is reasonable to conclude that PLTW implementation may become more intriguing to WELS schools. However, there is a training process - which requires both time and money - to prepare teachers for the unique nature and content of these classes. This can be a potential obstacle for schools that are new to PLTW, or schools that need to replace a PLTW teacher. The researcher recommends that the Commission on Lutheran Schools and leaders of Martin Luther College discuss potential solutions, making use of guidance from WELS grade schools and high schools that currently use PLTW.

In Conclusion

This research study has analyzed the effect of the STEM curriculum, "Project Lead the Way" on WELS Schools. There are advantages of this curriculum that may be beneficial for some WELS schools. However, the survey results do not give a definitive answer about whether or not PLTW should be implemented in all WELS schools, or even at a particular school. Ultimately, school leaders will need to decide what is best to help them carry out their mission so that God's love can be shared in the most effective and efficient way possible, following God's instruction to "train a child in the way he should go, and when he is old he will not turn from it." (Proverbs 22:6). Thankfully, regardless of whether or not PLTW (or any other curriculum) is

implemented, the living and enduring Word of God is the ultimate source of knowledge and the

foundation of everything that is taught in WELS schools. To God be the glory!

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Appendix A: Teacher/Administrator Survey

SECTION 1 - Introduction (all respondents)

SECTION 2 - Demographic Information (all respondents)
1. Your school type:
    a. Elementary school
    b. High school
2. Your school location:
    a. Rural
    b. Urban
    c. Suburban
3. Your gender:
    a. Male
    b. Female
4. Your Race/nationality:
    a. American Indian or Alaska Native
    b. Asian
    c. Black or African American
    d. Hispanic or Latino
    e. Native Hawaiian or Other Pacific Islander
    f. White/Caucasian

SECTION 3 - Mission of the School (all respondents)
1. To what extent has the <u>mission of the school</u> been affected in schools that have implemented PLTW curriculum?
    a. Major positive impact
    b. Minor positive impact
    c. No change in our ability to meet our mission
    d. Minor negative impact
    e. Major negative impact

2. If there has been a change in the school's ability to meet its mission, what other factors besides PLTW implementation may have caused this?

3. Please share any other insight regarding mission of the school that might be beneficial to this study:

SECTION 4 - Teacher Satisfaction & Team Morale (all respondents)
1. How has your satisfaction as a teacher (whether or not you teach a PLTW course) been affected by the implementation of PLTW at your school?
    a. Major positive impact
    b. Minor positive impact

      c. No change in personal satisfaction
      d. Minor negative impact
      e. Major negative impact

2. How has teamwork among teachers been affected by the implementation of PLTW at your school?
      a. Major positive impact - the faculty/staff functions much more as a team than they did previously
      b. Minor positive impact - the faculty/staff functions a little more as a team than they did previously
      c. No impact
      d. Minor negative impact - the faculty/staff functions a little less as a team than they did previously
      e. Major negative impact - the faculty/staff functions much less as a team than they did previously

3. If there has been a significant change in teacher satisfaction and/or team morale, what other factors besides PLTW implementation may have caused this?

4. Please share any other insight regarding teacher satisfaction and/or team morale that might be beneficial to this study:

SECTION 5 - School Climate & Culture (all respondents)

1. To what extent has the <u>school climate and culture</u> been affected since your school has implemented PLTW curriculum?
      a. drastic improvement
      b. moderate improvement
      c. there has been no change
      d. moderate decline
      e. drastic decline

2. If there has been a change in school climate and culture, do you feel it is because of PLTW implementation?
      a. Yes, fully
      b. Yes, but only partially
      c. No
      d. n/a

3. If there has been a change in school climate and culture, what other factors besides PLTW implementation may have caused this?

4. Please share any other insight regarding school climate and culture that might be beneficial to this study:

SECTION 6 - Curriculum (all respondents)

1. To what extent has the <u>school-wide curriculum</u> been affected since the implementation of PLTW at your school?
   a. It has been a major challenge to "fit it in" to the pre-existing curriculum
   b. It has been minor challenge "fit it in" to the pre-existing curriculum
   c. There was no issue in implementation

2. The implementation of PLTW has been a positive addition to our school-wide curriculum.
   a. Strongly agree
   b. Somewhat agree
   c. Undecided
   d. Somewhat disagree
   e. Strongly disagree

3. If there have been any significant changes in school-wide curriculum, what other factors besides PLTW implementation may have caused this?

4. Please share any other insight regarding school-wide curriculum that might be beneficial to this study:

SECTION 7 - Respondent Type (all respondents)

1. Choose any of the following that describe yourself:
   a. Principal/administrator in a PLTW school
   b. Principal/administrator at a previous school that used PLTW
   c. Current PLTW Teacher
   d. Previous PLTW Teacher
   e. Non-PLTW teacher in a school that currently uses PLTW
   f. Non-PLTW teacher that previously taught in a school that used PLTW
   g. none of the above

SECTION 8 - PLTW Courses Taught (Teachers) (PLTW teachers only)

1. To what extent does your school currently make use of PLTW curriculum?
   a. <u>ZERO</u> Implementation - The PLTW curriculum is not used at all
   b. <u>MINIMAL</u> Implementation - (Elementary: a minority teachers are using 1-2 modules sporadically; High School: only 1-2 courses are taught; not part of a program)
   c. <u>MODERATE</u> Implementation - (Elementary: majority of teachers are teaching at least 2 modules per year; High School: all three tracks are offered, but only in part; or 1-2 tracks are fully developed, but not all three)
   d. <u>FULL</u> Implementation - (Elementary: 4 modules are taught at every grade level; High School: all 3 tracks are available in a 4-year program)

2. In the past three years (Aug 2017 - May 2020), which PLTW "Launch" course(s) have you/will you personally teach? Mark all that apply.
    a. none
    b. Life Science: Living and Nonliving Things (PreK)
    c. Matter: Floating and Sinking (PreK)
    d. Healthy Habits (PreK)
    e. Spatial Sense and Coding (PreK)
    f. Structure and Function: Exploring Design (K)
    g. Pushes and Pulls (K)
    h. Structure and Function: Human Body (K)
    i. Animals and Algorithms (K)
    j. Light and Sound (1st)
    k. Light: Observing the Sun, Moon, and Stars (1st)
    l. Animal Adaptations (1st)
    m. Animated Storytelling (1st)
    n. Materials Science: Properties of Matter (2nd)
    o. Materials Science: Form and Function (2nd)
    p. The Changing Earth (2nd)
    q. Grids and Games (2nd)
    r. Stability and Motion: Science of Flight (3rd)
    s. Stability and Motion: Forces and Interactions (3rd)
    t. Variation of Traits (3rd)
    u. Programming Patterns (3rd)
    v. Energy: Collisions (4th)
    w. Energy: Conversion (4th)
    x. Input/Output: Computer Systems (4th)
    y. Input/Output: Human Brain (4th)
    z. Robotics and Automation (5th)
    aa. Robotics and Automation: Challenge (5th)
    bb. Infection: Detection (5th)
    cc. Infection: Modeling and Simulation(5th)

3. In the past three years (Aug 2017 - May 2020), which PLTW "Gateway" course(s) have you/will you personally teach? Mark all that apply.
    a. none
    b. Design & Modeling
    c. Automation and Robotics
    d. App Creators
    e. Computer Science for Innovators and Makers
    f. Energy and the Environment
    g. Flight and Space
    h. Science of Technology
    i. Magic of Electrons
    j. Green Architecture
    k. Medical Detectives

4. In the past three years (Aug 2017 - May 2020), which PLTW high school "Engineering" course(s) have you/will you personally teach? Mark all that apply.
   a. none
   b. Intro to Engineering Design
   c. Principles of Engineering
   d. Aerospace Engineering
   e. Civil Engineering and Architecture
   f. Computer Integrated Manufacturing
   g. Computer Science Principles
   h. Digital Electronics
   i. Environmental Sustainability
   j. Engineering Design and Development

5. In the past three years (Aug 2017 - May 2020), which PLTW high school "Bio-medl" course(s) have you/will you personally teach? Mark all that apply.
   a. none
   b. Principles of Biomedical Science
   c. Human Body Systems
   d. Medical Interventions
   e. Biomedical Innovation

6. In the past three years (Aug 2017 - May 2020), which PLTW high school "Computer Science" course(s) have you/will you personally teach? Mark all that apply.
   a. none
   b. Computer Science Essentials
   c. Computer Science Principles
   d. Computer Science A
   e. Cybersecurity

SECTION 9 - PLTW Courses Offered (Administrators) (Administrators only)
1. To what extent does your school currently make use of PLTW curriculum?
   a. <u>ZERO</u> Implementation - The PLTW curriculum is not used at all
   b. <u>MINIMAL</u> Implementation - (Elementary: a minority teachers are using 1-2 modules sporadically; High School: only 1-2 courses are taught; not part of a program)
   c. <u>MODERATE</u> Implementation - (Elementary: majority of teachers are teaching at least 2 modules per year; High School: all three tracks are offered, but only in part; or 1-2 tracks are fully developed, but not all three)
   d. <u>FULL</u> Implementation - (Elementary: 4 modules are taught at every grade level; High School: all 3 tracks are available in a 4-year program)

2. In the past three years (Aug 2017 - May 2020), which PLTW "Launch" course(s) have been/will be taught at your school? Mark all that apply.
   a. none
   b. Life Science: Living and Nonliving Things (PreK)
   c. Matter: Floating and Sinking (PreK)
   d. Healthy Habits (PreK)
   e. Spatial Sense and Coding (PreK)
   f. Structure and Function: Exploring Design (K)
   g. Pushes and Pulls (K)
   h. Structure and Function: Human Body (K)
   i. Animals and Algorithms (K)
   j. Light and Sound (1st)
   k. Light: Observing the Sun, Moon, and Stars (1st)
   l. Animal Adaptations (1st)
   m. Animated Storytelling (1st)
   n. Materials Science: Properties of Matter (2nd)
   o. Materials Science: Form and Function (2nd)
   p. The Changing Earth (2nd)
   q. Grids and Games (2nd)
   r. Stability and Motion: Science of Flight (3rd)
   s. Stability and Motion: Forces and Interactions (3rd)
   t. Variation of Traits (3rd)
   u. Programming Patterns (3rd)
   v. Energy: Collisions (4th)
   w. Energy: Conversion (4th)
   x. Input/Output: Computer Systems (4th)
   y. Input/Output: Human Brain (4th)
   z. Robotics and Automation (5th)
   aa. Robotics and Automation: Challenge (5th)
   bb. Infection: Detection (5th)
   cc. Infection: Modeling and Simulation(5th)

3. In the past three years (Aug 2017 - May 2020), which PLTW "Gateway" course(s) have been/will be taught at your school? Mark all that apply.
   a. none
   b. Design & Modeling
   c. Automation and Robotics
   d. App Creators
   e. Computer Science for Innovators and Makers
   f. Energy and the Environment
   g. Flight and Space
   h. Science of Technology
   i. Magic of Electrons
   j. Green Architecture
   k. Medical Detectives

4. In the past three years (Aug 2017 - May 2020), which PLTW high school "Engineering" course(s) have been/will be taught at your school? Mark all that apply.
    a. none
    b. Intro to Engineering Design
    c. Principles of Engineering
    d. Aerospace Engineering
    e. Civil Engineering and Architecture
    f. Computer Integrated Manufacturing
    g. Computer Science Principles
    h. Digital Electronics
    i. Environmental Sustainability
    j. Engineering Design and Development

5. In the past three years (Aug 2017 - May 2020), which PLTW high school "Bio-medl" course(s) have been/will be taught at your school? Mark all that apply.
    a. none
    b. Principles of Biomedical Science
    c. Human Body Systems
    d. Medical Interventions
    e. Biomedical Innovation

6. In the past three years (Aug 2017 - May 2020), which PLTW high school "Computer Science" course(s) have been/will be taught at your school? Mark all that apply.
    a. none
    b. Computer Science Essentials
    c. Computer Science Principles
    d. Computer Science A
    e. Cybersecurity

SECTION 10 - Enrollment (Administrators only)
1. Compared to previous enrollment trends, to what extent has <u>enrollment</u> been affected since the implementation of PLTW at your school?
    a. Major growth
    b. Minor growth
    c. No change
    d. Minor decline
    e. Major decline

2. If there has been a significant change in enrollment, what is the make-up of your school as you grow or decline? (check any that apply)
    a. as we've grown, it is mostly WELS students that tend to enroll
    b. as we've grown, it is mostly community students that tend to enroll
    c. as we've declined, it is mostly WELS students that tend to unenroll

      d. as we've declined, it is mostly community students that tend to unenroll
      e. none of these apply

3. If there has been a significant change in enrollment, what other factors besides PLTW implementation may have caused this?

4. Please share any other insight regarding enrollment that might be beneficial to this study:

SECTION 11 - Marketing & Recruitment (Administrators only)

1. To what extent has <u>marketing & recruitment</u> been affected in schools that have implemented PLTW curriculum?
      a. Major positive impact - It is much easier to market/recruit than it was before
      b. Minor positive impact - It is slightly easier to market/recruit than it was before
      c. No impact - marketing and recruitment remains nearly the same
      d. Minor negative impact - It is slightly more difficult to market/recruit than it was before
      e. Major negative impact - It is much more difficult to market/recruit than it was before

2. If there has been a significant change in marketing/recruiting, what other factors besides PLTW implementation may have caused this?

3. Please share any other insight regarding marketing/recruiting that might be beneficial to this study:

SECTION 12 - Test Scores (Administrators only)

1. To what extent have math <u>standardized test scores</u> been affected since the implementation of PLTW at your school?
      a. Major growth
      b. Minor growth
      c. No change
      d. Minor decline
      e. Major decline
      f. n/a

2. Please explain your response concerning math standardized test scores.

3. Do you have access to data that justifies your answer to the previous question regarding math standardized test scores?
      a. Yes
      b. No
      c. n/a

4. To what extent have science <u>standardized test scores</u> been affected since the implementation of PLTW at your school?
   a. Major growth
   b. Minor growth
   c. No change
   d. Minor decline
   e. Major decline
   f. n/a

5. Please explain your response concerning science standardized test scores.

6. Do you have access to data that justifies your answer to the previous question regarding science standardized test scores?
   a. Yes
   b. No
   c. n/a

7. To what extent have reading <u>standardized test scores</u> been affected since the implementation of PLTW at your school?
   a. Major growth
   b. Minor growth
   c. No change
   d. Minor decline
   e. Major decline
   f. n/a

8. Please explain your response concerning reading standardized test scores.

9. Do you have access to data that justifies your answer to the previous question regarding reading standardized test scores?
   a. Yes
   b. No
   c. n/a

10. If there have been any significant changes in standardized test scores, what other factors besides PLTW implementation may have caused this?

11. Please share any other insight regarding standardized test scores that might be beneficial to this study:

SECTION 13 - Budget (Administrators only)
1. To what extent has the <u>school (or overall ministry) budget</u> been affected in schools that have implemented PLTW curriculum?
    a. Major negative affect - Financially, implementing PLTW was extremely difficult. It has put a significant strain on the budget.
    b. Moderate negative affect - Financially, implementing PLTW was a moderate challenge. We made it work in the ministry budget, but had to shift priorities.
    c. No effect - Financially, implementing PLTW was not difficult at all.
    d. Positive effect - PLTW implementation has created opportunities for our income stream to increase

2. Were you able to obtain outside-the-budget funding (donations, grants, etc) in order to help defer the cost of PLTW implementation?
    a. No
    b. Yes, minor assistance
    c. Yes, major assistance

3. If there has been a change in school budget, do you feel it is because of PLTW implementation?
    a. Yes, fully
    b. Yes, but only partially
    c. No

4. If there has been a significant change in ministry budget, what other factors besides PLTW implementation may have caused this?

5. Please share any other insight regarding PLTW and budget that might be beneficial to this study:

SECTION 14 - Closing Remarks (All respondents)
1. Do you have any other insight regarding the use of PLTW in WELS schools?

2. (Optional): Your name

3. (Optional): Your school

Appendix B: Communication Plan for Optimal Survey Responses

Timeline
December - Phone call to all principals (obtain email lists)
January 2 - Email sent out to all teachers
January 15 - follow-up email to teacher (only 2 days left to complete)
January 17 - Surveys completed by this date; survey no longer available

Phone call to principals (scripted)
Hello _____,
Thanks for your time. My name is Pete Gumm. I am a teacher at Shoreland Lutheran High School in SE Wisconsin, and I'm in the process of completing my Thesis to obtain my master's degree through MLC. The thesis will be examining the effect of the Project Lead The Way curriculum on our WELS elementary and high schools. So, I guess I should first verify...your school does make use of the PLTW curriculum, correct?

Perfect. What I am hoping to do is get survey responses from all administrators and all instructors (whether they are PLTW teachers or not) from each of our WELS schools that uses the PLTW curriculum. Would it be okay if I reached out to your faculty via email to do this?

I had originally reached out to CLS to get a contact list of teachers, but they could only share school data...not a list of teacher emails. Would it be possible to get a spreadsheet from your school that has a list of faculty email addresses? (If that's not available, is your website up to date so that I could grab them individually from there?)

I'll let you know about the timeline that I'm hoping to have with this:
- For the next month or so, I'll be gathering emails
- Because of the extremely busy time of year leading up to Christmas, I'm going to wait until January 2 to send the survey out to teachers...I'm hoping to catch a few of them with some extra time over Christmas break
- On about January 8, I'll reach out to you via email to request that you forward that same email with an encouragement to your faculty to complete it.
- I'm hoping to get all responses submitted by January 17.

Thanks so much! I'm really hoping I get a fairly substantial response. Only 9% of our schools use PLTW, so my pool of those to survey is already relatively small! I really appreciate your faculty helping out with this, and any extra encouragement from you to have them complete it would also be appreciated.

January 2 - Email to all teachers

Hello rock-star teachers of _____,

I am in desperate need of your feedback in a survey that pertains to WELS Schools that make use of the Project Lead the Way curriculum. **This is meant for <u>ALL</u> teachers**, not just those who teacher PLTW. This research is part of my MLC master's program thesis. The sample size for this type of survey and analysis is somewhat limited because only 9% of WELS Schools (LES and LHS) makes use of PLTW. Not all WELS teachers are being asked to complete this survey. You serve at one of these schools, which makes your input crucial.

I know your time is valuable, and I'm confident that it will be time well spent. Please know that the results and analysis of this survey will hopefully provide a great resource for many of our fellow WELS schools/teachers. The approximate time it will take to complete the survey is minimal and will be different depending on your level of interaction with PLTW at your school:
- Non-PLTW teachers: 3-5 minutes
- PLTW teachers: 5-7 minutes
- Administrators: 7-12 minutes

I am requesting that you complete the survey by Friday, January 17, but if you have a few moments over Christmas break, the sooner the better!

Access the survey here: [PLTW in WELS Schools](#)

Thank you. Thank you. Thank you! Your responses are greatly appreciated. God's continued blessings on your ministry!

(Also, if you know of any previous co-workers that had been affiliated with a PLTW school, but no longer are, please feel free to pass this on to them. Their input would also be valuable.)

January 15 - Follow-up Email to all teachers:
Thanks so much to all of you who have already completed this survey. The results are interesting, but the sample size is still somewhat small. If you haven't yet completed it, I'd ask that you do so in the next 2 days. I'm hoping to have all the responses completed by midnight on Friday, January 17. Thanks so much!

Appendix C: Possible Subjects and School Breakdown

ELEMENTARY SCHOOL ONLY	230
Bethany Lutheran School	6
Bloomington Lutheran School	3
Immanuel Lutheran School	13
Mt Lebanon Lutheran School-Alpha Campus PK-4	16
Riverview Lutheran School	5
St Jacobi Lutheran School	11
St John Lutheran School, Libertyville	6
St John's Lutheran School, Burlington	8
St Lucas Lutheran School	18
St Marcus Lutheran School	60
St Mark Lutheran School	11
St Matthew's Lutheran School	12
St Paul's Lutheran School	15
Star of Bethlehem Lutheran School	12
Trinity Lutheran School	12
Wisconsin Lutheran School-Middle School (6-8)	11
Word of Life Lutheran School	6
Zion Lutheran School 3K-8th Grade	5

HIGH SCHOOL ONLY	260
Fox Valley Lutheran High School	52
Lakeside Lutheran High School	35
Manitowoc Lutheran High School	25
Northland Lutheran High School	7
Shoreland Lutheran High School	38
West Lutheran High School	14
Wisconsin Lutheran High School	89

HIGH SCHOOL / ELEMENTARY COMBINED	110
St. Croix Lutheran Academy	40
Divine Savior Lutheran Academy	70

TOTAL Potential Respondents: **600**

Appendix D: Qualitative Data for Mission

Please share any other insight regarding mission of the school that might be beneficial to this study:	
Mission Statement excerpt: "to train them in excellence for their roles in their family, church, community, workplace and country."	N
"Training children for now and eternity." The eternal part is first and foremost but helping children see that their lives are life's of service to their Lord is a key part of our mission.	P
A forward thinking administration	N
a school and a church need to work together to achieve the mission of the organization!	A
About 25% of our student body participates in the Wisconsin Parental Choice Program.	N
Any work that gets students out of their seats and uses a lab. setting always can have some positive benefits!	N
As someone not trained in or teaching PLTW, one concern I do have is our school's continued involvement in academic programs that largely control the curriculum, syllabus, and testing requirements of those courses. I am concerned that we become dependent of the materials or are restricted by them, and that these companies then eliminate or reduce our Christ-centered curriculum.	N
Being "all things to all people" means knocking down all barriers to the gospel. These include perceptions from the public regarding what quality education looks like in today's world. It's the reason we pursue accreditation, achieve masters degrees, and strive for excellence.	E
I am a parish pastor wo teaches seniors Word of God and am new to the religion department. There is a great need to explore the curriculum map and improve our goals and outcomes. Help in this area would greatly be appreciated.	N
I believe that some people have enrolled children in our school because they heard about Project Lead the Way and believe that this program would be very beneficial for their child.	E
It's all about JESUS!! Not just words but it is.	N
It's hard to differentiate Wisco as urban or suburban as we are uniquely both for an LHS. Many of our urban students are woefully underprepared for high school which I assume makes PLTW out of range for many of our school.	N
Lives of service	P
Many AP courses have been introduced. We also have a robotics team.	N
Mission: Wisconsin Lutheran School partners with families to proclaim the forgiveness of sins, to provide a Christ-centered quality education, and to prepare students for a lifelong love of learning and service to God and the community. (PLTW aids in preparing students for the lifelong love of learning and service to God and the community.)	P
more recruiting efforts outside of our federation	G

My sainted father used to admonish our attempts at over-achievement with the words, "You're trying to put 10 pounds of potatoes in a 5 pound sack." Today in education we are indeed trying to do that with the many, many initiatives available to students. In and of themselves, they are almost always valuable programs. But combined together in a total school curriculum, they put administrators, teachers, parents, and students in a virtual rat race to "get everything in." And then we wonder why our students and teachers are stressed to the max. Usually we try to alleviate this condition by redesigning the sack with alternative scheduling and the like, but the problem is still the number of potatoes. I am waiting for the sane individual/school that finally says, "Enough."	N
Negatives- tied to that teacher which completed the training, the cost of materials and purchase of supplies through specific vendors. As a Career and Technology teacher- I think schools need to continue to train our youth in the trades as they explore their God given talents. In taking students through Briggs and Stratton R & D, they will openly admit that the engineers coming out of colleges are not as well rounded as they could be. The total student needs to focused on, the arts, communication, etc.	A
one of out target goals is achieve. Students who have not been in any clubs are flocking too and achieving through the robotics club	E
Our mission is to assist parents in providing a Christ centered education. It has God's Word as the foundation of all learning and this foundation is evidenced in every academic area.	N
Our mission is to disciple children for Christ for now and for all eternity and train them in excellence for the their roles in the community, church, family, workplace and country.	N
Our mission is to educate, equip, and encourage students for lives of Christian service through our Christ-centered programs. PLTW pathways are designed to prepare students to live lives of Christian service in STEM related careers. Ultimately we want to share Jesus with more young people. The PLTW pathways have provided this opportunity.	P
Our mission is to prepare students to be disciples of Christ, and although God is intertwined in all of the curriculums, our science curriculum has involved that focus in previous years as well.	P
Our mission is to train students for the world, and today's world is about creativity and collaboration. I believe that PLTW does a good job of training our students for today's workplace.	P
Our mission statement is: Educating the total student – spiritually, intellectually, and physically – in a caring, Christian family community. We still have many other ways that we are able to meet our mission statement other than PLTW.	A
Our mission to assist parents in excellent Christian education has not bee changed due to PLTW. The PLTW allows us to add offerings to our excellent education.	E
Our mission was reduced from a paragraph to a short phrase within the last 5 years.	N
Our new PLTW course has interested students, although not to the level faculty was hoping. Our new robotics club (sponsored in an effort to continue PLTW interest) has been successful in competition, but only has a small handful of students involved.	N
Our purpose is to reach more than just WELS students. Having PLTW STEM Classes as an offering not only serves our WELS students, it provides an attraction to those from the community and to our international students.	G

Our school has transformed into a STEM leader in the Milwaukee area. Students and families are drawn to our school because of the hands on learning environment.	**G**
Our school is blessed to have administration positions that have the time and resources to focus on "big picture" long-term planning for the school.	**N**
Our school relying on PLTW and STEM curriculum as its major marketing and recruitment emphasis have negatively impacted so many of the other outcomes that a high school student should be considering when entering a high school setting and when leaving that setting. That coupled with the religious and worship restrictions and reactions that have come as a result of our participation in the school choice program have severely, negatively impacted the ability of our school to currently carry out its mission statement. Which makes it ridiculously ironic that our school is now considering revising our mission statement to better match the current practices of the school. A mission/ideology should start with a philosophy and move toward implementation/practice, not the other way around. Our school, and our synod's school system are both moving in a dangerous and backward direction when we have practice driving our philosophy rather than the other way around.	**A**
Our school was growing already, so it's hard to say what kind of impact PLTW has had.	**N**
Our student body is very diverse and the PLTW curriculum seems to appeal to that diverse group of students. The PLTW curriculum exposes our students to a great problem-solving and real-world applications.	**G**
Part of our mission is to train the students to be productive members of society. This includes collaboration with peers.	**P**
PLTW aligns with our mission to educate the "total student" and be the "global leader" in college preparation.	**P**
PLTW course incorporate 20th century skills and teaching strategies. Having those courses in our curriculum bolsters our capacity for strengthening the academic structure of other courses, which strengthens our curriculum and instruction and advances our ability to realize our mission.	**P**
PLTW courses are all optional and none are required for graduation, nor do they count for science required credits. It really is just an add on that some students take advantage of but is very expensive.	**N**
PLTW courses help with the "sale" of Christian education at FVL. I hate to say it but parents feel like they are getting a great value for their tuition dollars.	**E**
PLTW has been a feather in the cap so to speak when we promote our school to the community.	**G**
PLTW helps address "prepares young adults for productive, Christ-centered lives" as well as "for those seeking a comprehensive Christian high school experience".	**P**
PLTW is one aspect of instruction at our school that has created a reputation of rigorous academics and preparedness for high school. I believe that this reputation has equipped us to be more effective in reaching students who might not otherwise attend a Christian school.	**E, P**

PLTW seeks to encourage student development in professional characteristics such as communication, collaboration, creativity, critical thinking, grit, and ethics. It is not to say that these habits are not developed in other curricular areas, because they are. However, I believe that these courses put students in a greater position to develop these skills than other traditional curricular areas do. These are characteristics that are vitally important to whatever vocation students are led to. Despite the fact that these courses expose students to the career fields of engineering, computer science, or biomedical science I take great pride in the students who pursue being educators after taking these courses. These future teachers will be transformative in their classrooms because of the way they have engaged in the learning process through PLTW.	P
PLTW should be included in promotional campaigns	G
PLTW, other than being a "class", has not seemed to turn into a major focus for the school. I believe in "hand's-on" learning so I think it is a great offering. I'm not sure how it really meets our mission.	N
Possible additional students attend	G
School Choice non-WELS members participating and succeeding in PLTW.	G
Some positives for those interested in pursuing engineering. Starting to affect students' ability to pursue non-required subjects such as band/choir	N
STEM programs attract students and parents to the school	G
The administration here keeps the mission in front of all stakeholders at all times; it's on the walls in our meeting rooms, in the president's reports, etc.	N
The mission has been reevaluated and PLTW is still very new. The impact will likely grow over time, but is minimal due to its short time frame.	N
The mission of the school is: Wisconsin Lutheran School partners with families to proclaim the forgiveness of sins, to provide a Christ-centered quality education, and to prepare students for a lifelong love of learning and service to God and the community.	N
The mission of the school to offer college level courses in AP coursework, plus traditional curriculum and PLTW is too broad. In the past, our school has required 4 years of science, but it considering cutting this to 3 years which is the state's requirement. This may help our school balance the teaching load better.	N
The PLTW curriculum enhances our academic offerings and has been met with "open arms" among the parents and students we serve.	E
The PLTW curriculum is new to our middle school this year. I am also a new teacher to the school, so I do not know if the implementation of the curriculum has made an impact on our mission.	N
The PLTW curriculum our school offers has given families another reason to choose our school to send their children to. We want to give families a variety of experiences at school as they hear the Gospel message shared every day.	G
The program also provides course options for non 4 year college bound students	G
The program draws interest to non-WELS traditional families to enter our school. It has made our school a stronger mission field.	G
The school itself is in a mission area and has been assisted in growth by providing a high quality of education in the area.	G, E

The STEM classes allow us to "market" ourselves to students that are interested in the sciences. They may come here for STEM, but they also get the gospel and Christ-centered education.	G
There has been a lot of change over and so that original staff that was the "core" when PLTW was implemented has not stayed long so refocusing and understanding the mission of the school and how PLTW fits is a bit fluid.	N
This allows students with an interest or abilities in STEM-related fields to become better equipped in those areas of study.	P
This school competes with high-level schools and a successful school district in the surrounding area.	E
Ultimately, our mission is to help our students know Jesus and grow closer to him. PLTW allows students to someday bring their christian faith into a workplace that has a large impact on society.	P
We are a large school. One teacher has implemented PLTW. I don't know much about it.	N
We are in the first year of implementation of PLTW. At this point, I don't believe that there has been any impact, either positive or negative, on our mission. Our mission itself does not change because of our use of PLTW. We would view the use of this curriculum as a tool that aids in our ability to carry out the school's mission. Aiding God's children grow in their appreciation and knowledge of God's creation and God given abilities is an expected outcome. Attracting new students and retaining current students may also be a benefit as we carry out our mission.	A
We are in the process of writing a new mission statement. PLTW has not been mentioned in any of the multiple discussions.	N
We are opening up to our community more and businesses are interested in what we are doing	G
When families are considering our school, I feel that they are excited that we are are part of the PLTW community. They like to see the hands-on/real-life type of learning.	G
While I am not a PTLW teacher, I have seen more cross-grade level collaboration because of it. For example, our middle schoolers held a science fair of sorts and invited primary grades to view their models.	N
Wisco is committed to providing a comprehensive curriculum. I think of it less as a STEM curriculum, and more as an additional valuable component of a well rounded student, just as any of the fine arts or practical arts are.	E
Zion's 2019 annual Family Fun Fair featured games made by 7th and 8th graders as STEM projects. It seemed to be a positive way to showcase projects they had worked on at school. A family with young children recently toured our school, and expressed interest in seeing STEM projects that upper-level students are currently working on for 2020 Family Fun Fair. (contact Dr. John Freese, principal and grades 7-8 teacher for more information on these potential effects)	N

If there has been a change in the school's ability to meet its mission, what other factors besides PLTW implementation may have caused this?	
Our program helps to meet our Recruitment and Outreach needs	O
"Training children for now" has always meant providing the best academic education for the	E

students.	
A new EC Center is currently being built.	**F**
Adding additional AP courses	**P**
Adding new trades courses, more global perspective, positive thinking, goal setting, arrival of Fox conn	**P**
addition of an admissions/recruitment position	**S**
Additional enrollment / interest due to natural fluctuation of the area (army families, EMPOWER IL, etc.)	**N**
Administration	**L**
All of our curriculums have been adapting to society's changes, especially in technology.	**N**
An additional emphasis in Trades education.	**P**
Balancebetween textbook and PLTW	**E**
Bigger enrollment; better extracurriculars; more programs	**O, P**
Building a new school	**F**
Building classrooms	**F**
building expansion, state tuition paid	**F**
Change in leadership	**L**
Emphasis on "Trades" Education--previously known as "Industrial Arts" now commonly known as "Technical Education".	**P**
expansion in the trades, addition and change of staff and faculty	**P, S**
Focus on culturally responsive teaching, curriculum mapping, course flow and staffing changes	**E, S**
Focus on mission and developing Christians	**C**
For the last three years, my high school has had a president as part of the school's administrative team. This person really emphasizes the need to fulfill our mission statement. Consequently, the faculty and staff might be working harder to meet that goal.	**L, E**
General school growth	**O**
God blesses us.	**C**
Great teachers on our middle school's team	**S**
I believe PLTW course appeal to certain students who might decide to enroll in a local public school instead or our school, if we did not offer those courses. Thus the courses increase our opportunity to reach students who have those interests with the Gospel.	**N**
I believe that parents want the best education for their child. PLTW helps with that but it also develops learners who are good problem solvers. I believe this skill is something parents look for for their children.	**E, O**
I don't feel that I have been at the school long enough to comment on this. I've only been here for 1-2 years.	**N**
Impact of Leadership on culture	**L**

Implementation of interim assessments to drive instructional decisions. Increased efforts in marketing. Increased time for pastors to meeting with students.	**O, S**
Improved leadership and cooperation among staff and faculty; improved professionalism among those who are meeting in PLCs	**L, S, E**
In the middle school, we try out strategies (and in this case curricula) that address the needs of the whole student. One-to-one devices and project-based learning	**E**
Inclusion of Vouchers	**V**
Increased outreach in the community, School Choice vouchers, increased financial aid accessibility, increase in faculty professional development	**O, V, E**
increased recruitment; MAP testing; change in administrative structure	**O, L**
It allows for kids to do deeper level problem solving on their own with hands on learning	**E**
It is a potential attractor to outsiders	**O**
leadership in the church	**L**
Major Change in Administration	**L**
More appeal to suburban families	**O**
more curricular offerings	**P**
More ways for students to use their gifts.	**N**
Mount Lebanon has gone through tremendous cultural and curricular change in the last 4.5 years. We have also done a mission, vision, core values reset.	**N**
new school building completed and opened September 2018	**F**
Not neccearily the mission of the school but PLTW uses inquiry based science and hands on science actitivites which we know is a great way to teach science.	**E**
Not sure if we do PLTW	**N**
Nothing has been added or changed that has effected the school's ability to reach for it's mission.	**N**
Offering welding classes	**P**
only one teacher uses PLTW	**N**
Other non-PLTW courses and cocurriculars that have been added.	**P**
Our focus on Character development and profound learning	**C**
Our school also started a robotics club that meets once or twice a month.	**P**
Overall greater focus on the purpose of education	**E**
Overall quality Christian education experience on a stunning 63 acre campus	**C, F**
Part of our mission says we offer college-prep academics, supportive teachers, and a Christian environment to share Christ's love with our students and families. I feel this has been an added benefit to our college-prep curriculum, which makes our school more attractive to the community, which then allows us to give them those two other components of our mission.	**C, E**

PLTW course are exposing our students to skills they will need that they might not be getting in more traditional high school courses.	N
PLTW engages male students, helping meet the mission of achievement. It gives students skills that are currently marketable in the community which goes to strengthen families and workplaces in turn strengthening churches and the country.	N
PLTW was part of an initiative to promote technology and hands on science in a relevant way.	N
Positive and encouraging staff	S
Pretty tough question here as meeting the mission of the school is very high level when the particular instructional resource a school uses shouldn't have a major impact in changing the schools ability to meet mission.	N
Priorities within the family has changed and God's Word is no longer the top reason to attend our school.	N
Professional development took a step forward. Kids and parents are getting used to a standards/skills based way of grading and looking at education.	E
Quickly growing area, good reputation in the community, good marketing	O
Recent construction of additional classrooms.	F
Scheduling conflicts have increased forcing students into difficult decisions that are unnecessary.	N
School Choice also affects the ability of our school to effectively meet its mission.	V
School Choice, College Courses	V, P
Slowly other staff are learning about the courses and outcomes. We are not early adopters as a school. I taught in public school in 15 years where we had joined about that many years ago. It is a canned national curriculum which can be similarly offered in rigor in math, science, arts and tech ed classes.	N
Staffing shifts and additions	S
Starting an FRC team	P
State and Racine School Choice Programs	V
strong robotics program drawing some families to our school	P
Supporters of our school have donated time and talents in promoting and coaching a robotics team as well.	O, P
The number of teachers needed to cover both science and PLTW curriculum stretches the school curriculum coverage.	N
There has been a huge change in our ability to meet our mission on account of additional funding, better staff retention, better leader retention, stronger leaders, etc. PLTW has improved our ability to meet its mission because our science program is much more effective which is good for students and appealing to parents.	S, L
There has been improvements in our ability to prepare students for provide a quality education and create life-long learners. Students have enjoyed different elements of PLTW, and it is preparing them for future careers and learning.	N

This is hard for me to answer. PLTW was implemented before I took a call to teach here, and I've only been here for 6 months.	**N**
Voucher program	**V**
We are just starting PTLW. We don't have that much info to pass on yet.	**N**
we are now School Choice and have been working on being more visible to the community	**V**
We did build a brand new school which is pretty awesome!	**F**
We have added a new addition to our school, and the STEM room is a huge component in this addition.	**F**
We have been able to better meet the needs of students interested in pursuing careers in engineering. It has also allowed students an avenue to apply math and science.	**N**
We have built new facilities and expanded offerings for other electives also, not just PLTW	**F, P**
We have had a changeover in teachers, a continued re-focus on our mission, other professional growth opportunities.	**S, E**
We have had a fairly significant change by calling more veteran teachers	**S**
We have implemented the first FRC robotics program in our school we are in its third year of operation. we have also Incorporated stem structured classes in our current courses and modified our curriculum to meet more stem guided activities in our science department	**P**
WI Parental Choice Program	**V**
Wisconsin School Choice Program	**V**
Work by the faculty to unite in our mission	**E**

Appendix E: Quantitative Cross-Sectional Trends Data for Mission

MISSION

PLTW Teachers

18	59	31%	Major positive
28	59	47%	Minor positive
14	59	24%	No change
0	59	0%	Minor negative
0	59	0%	Major negative

Grade School

21	119	18%	Major positive
53	119	45%	Minor positive
45	119	38%	No change
0	119	0%	Minor negative
0	119	0%	Major negative

Principals

10	30	33%	Major positive
12	30	40%	Minor positive
8	30	27%	No change
0	30	0%	Minor negative
0	30	0%	Major negative

High School

47	153	31%	Major positive
54	153	35%	Minor positive
48	153	31%	No change
3	153	2%	Minor negative
1	153	1%	Major negative

Non-PLTW teacher

37	159	23%	Major positive
62	159	39%	Minor positive
57	159	36%	No change
3	159	2%	Minor negative
0	159	0%	Major negative

Appendix F: Qualitative Data for School Climate and Culture

Please share any other insight regarding school climate and culture that might be beneficial to this study:	
Again, I was not here before the program's implementation to fully be able to answer this question. I gather there has been positive impact, but the school has also implemented other programs outside of PLTW (like coding and robotics classes) that seem to be contributing factors to the growth of climate and culture as well. However, many parents seemed excited at parent-teacher conferences that we offer these PLTW classes and chose to express it to me since I am one of the teachers in the program.	A
Asking students to solve complex problems together in small groups usually produces a positive experience, and in cases where it doesn't, there is opportunity to learn soft skills about dealing with difficult situations/people. It's good to experience these problems early.	S
Because a few students have transferred out of my high school in the past few years because they felt that they "didn't fit in", the administration, faculty, and class advisors have put forth a major effort to make the school climate and culture friendlier and more loving. To be honest, I have to say that I haven't noticed a significant change among the student body.	N
Change is expected to be positive and the interest contagious when we can start displaying student work and telling our stories.	P
Christ centered education has a greater impact on culture than PLTW	A
Classroom management expectations are high which helps PLTW projects move along and keep pace (they are challenging for students)	N
From my perspective, PLTW courses, while popular, are not given any special recognition/designation, they are simply different electives that can be taken.	N
I am please with school culture overall. There are some issues that remain, but student culture is a positive of the school in my opinion.	N
I believe a school's leader has everything to do with school climate and culture. I don't feel any one program can change a culture and climate.	A
I believe that students get excited about working together to complete the PLTW activities which truly builds teamwork skills in them.	S
I do think that PLTW has opened the door to opportunities that they never considered before. Students are also benefiting from opportunities that they have never had before. These opportunities have come about through the increased level of partnerships formed between education and industry. The PLTW program is causing more conversations to happen between industry and education giving administrators, educators, and schools a better understanding of the real world skills that have to be a part of a student's educational experience.	S
I don't believe that the school climate and culture have been affected by PLTW implementation. It only affects a small percentage of our students and there has been no discernible change.	N
I personally find the PLTW material very interesting. Some students feel likewise and it is amazing what they are capable of. Other students who have low work ethic grumble and complain - but they do that with their other studies as well. Regardless, PTLW is the future whether these kids think so or not.	N

I think kids have found science more engaging and enjoyed the hands-on nature of PLTW. This, I believe, has had a positive impact on climate and culture. Students are more eager to be in science.	S
In a large, departmentalized school, I don't think it's reasonable to expect or think that PTLW will be a driver of cultural change within the school unless the school has made PLTW it's singular major initiative.	N
It's been positive for a handful of students that participate, but it is only one of many programs at DSA	N
Joy in teaching/learning PLTW and discovering science in a way different from other classes (exploring and experimenting)	S
More of our students feel like they belong to the high school	I
Once a month, students participate in Spirit Squads which are made up of students in all grade levels K-8. They often work together to solve a STEM project. These projects encourage team building among students of all ages.	A
One of our science teachers (actually me) was getting an engineering ed grad. certificate in order to develop curriculum. The PLTW curriculum was adopted to speed the process and add credibility to the engineer program to outsiders	N
PLTW gave us the chance to add a robotics club this year. It is not VEX team.	I
PLTW has been beneficial in including some student who may not have participated in extra-curriculars in the past.	I
Same answers as previous question	N
Scheduling comments from earlier.	O
See past answers.	N
Shoreland's culture and climate as perceived by parents, federation members, alumni, and the community has improved greatly. Certainly impacted the reputation of the school.	N
Some students like the challenge of an unknown, especially when they perceive that the learning activity will be fun. This helps them have a better learning attitude thus somewhat helping the school climate.	S
students are putting effort into these courses; hands-on aspect is positive	S
Students don't have as much room in their schedule for all their classes. Especially at Shoreland- we offer many courses for the size of our student body	O
Students who are in PLTW are proud of their work and being in the program because they know it is a rigorous curriculum.	P
teacher micro-certifications (Microsoft, Google, Apple, SmartBoard, etc.)	N
The notion that students have to do things they have never done is somewhat intimidating. Prepping for and encouraging grit is important	S
The PLTW curriculum and its implementation require a mentality of "doing things with excellence." This mentality (culture) spills over into other areas.	S
The problem-solving mindset that accompanies PLTW is fantastic but I don't feel like it	N

permeates the school that deeply. Other work must be done to build relationships outside of curricula.	
the robotic team gets to share and show off their successes	P
The students / parents are mostly driven to excel and want high quality academics which pushes the school to add more curriculum without considering the impact on teaching load, quality, and balance. Doing AP, traditional, and PLTW is tough in any school. Asking teachers to teach different classes each year is also a stress that contribute to a tough school climate. Trying to be all things to all people can result in a decline in moral and culture at times.	O
This is my 4th year teaching. PLTW was implemented before I arrived. It would seem PLTW implementation has had a positive impact on the school.	N
This is only my second year there, but school climate and culture appears the same.	N
We have had more students accepted into schools like UW-Madison, particularly in Engineering. We also have more students considering Aerospace engineering. I feel that without PLTW - we would not have been as successful preparing students for these rigorous areas of study.	N
When an international student left the school because of a lack of engineering courses, that's when the push to PLTW started. Unfortunately, that has not really inspired other international students to enroll as others felt it would.	N

If there has been a change in school climate and culture, what other factors besides PLTW implementation may have caused this?	
"Let Your LIght Shine" has been and continues to be an additional motto for our students to display.	C
1) top-tier college planning program and 2) AP curriculum (including designated AP scholar levels)	P
a change in administration	L
A change in our students' demographics, backgrounds, etc.	D
A strong faculty all heavily invested in creating a great climate and culture.	T
A technology/engineering curriculum would have been added regardless of adopting PLTW; though likely not as rigorous	N
Academic growth matters. All students can learn and improve as individuals. Students have opportunity to explore Go Pro Early and Skilled Trades too. Teacher interaction-morning greeting, everyone with a homeroom.	T
Adding additional classes to the curriculum	P
Administration changes, addition of other courses	L, P
Administration team	L, P
Again, other additional course offerings to expand our comprehensive course offerings.	P

As a staff we have been working on many areas that can affect school climate. During meetings and professional development we have been working on better using MAPS test results, working in professional learning groups (by building) evaluating data collecting/assessments/student challenges, etc. One other thing we have done the last two years is placing all students on multi-grade teams and having fun activity days and group challenges to help with the separation caused by having three campuses.	**A, Q**
Better school community programs, better marketing of our school	**P**
Building a new school	**O**
Change in administration	**L**
change in adminstration, principal and pastor in last few years	**L**
Change in demographic, less parental involvement, change in administrationlvement, change in ad	**D, L**
change in faculty and staff, addition of other classes	**T, P**
Change in principal	**L**
change of staff and new school building with new families to reach out to	**T**
Changes in student body and student personalities/interests	**D**
Cultivating our "Family Feel" as we strive reach all our parents and students with the love of Christ.	**C**
Data Driven instruction implementation using MAP testing and online learning tools to meet students learning needs	**Q**
Different teachers and better leadership	**T, L**
Explicit discussion and study of race matters on staff and with the student body	**A**
First FRC robotics has made a significant positive impact in our school culture.	**P**
Focus on culturally responsive teaching and relational ministry	**A**
FOSS kits addition	**P**
FVL has made other efforts at improving school climate. Peer Leadership Group, mentor Bible studies, eSports, etc.	**P, A**
Girls feeling more apart of everything	**N**
high expectations of teachers with high support and life giving schedules/workloads, positive culture of collaboration, well facilitated collaboration	**T, L**
hiring a Dean of Students	**L**
I believe its having teachers that like to teach science.	**T**
I brought this up earlier with comments about also considering the effects on Fine Arts.	**N**
I feel it has been a slight change in focus toward getting more students familiar with hands on classes	**N**
I think that other factors that have impacted climate and culture are more clearly defined ideas of what a graduate of our high school looks like and what values they possess at their core.	**P**

I think the stability of teachers and the consistency in the rules may be factors in the school climate and culture.	M
Increased work by vice principals and administration to achieve behavior goals	L
Individual class dynamics and staff make-up are the key factors, more than any specific curricular change.	O
Intentional programming around maintaining and improving school culture.	A
It is harder. That blesses some and causes anxiety for others	N
Lack of student leadership in general	O
Leadership and discipline issues tackled by our administration play a large role too!	L, M
Mindset of continuous improvement, expansion of programming beyond PLTW offerings	P
More AP courses, other high-level courses	P
N/A	N
New administration	L
New Dean of students	L
new faculty	T
New leadership and a new college readiness/guidance counselor this year have both been positive climate and culture changes. Those have been the biggest, most notable changes this year.	L
New leadership, new faculty members, resource teachers added, and support staff added	L, T
new school, new teachers in three classrooms, new students	T
no change	N
none	N
None are obvious.	N
Once again, a refocus on our school's core values.	C
other curricular choices;	P
Our school climate has always been good, in my opinion. Students, teachers, and parents are excited by PLTW. The addition of a Robotics Club also offers another avenue for students to use their gifts. These are positive additions to an already great school climate.	P
Our school climate is very positive. It is a great place to work. PLTW is just another way that we can work together and collaborate.	N
Parent satisfaction	N
Participation in the Wisconsin Parental Choice Program, increased challenges of incoming Scriptural background of students and families, external stressors.	D
Please see comments from the previous two questions.	N
Policy changes, such as missing/late work and dress code, purposeful diversity training of teachers and students, addition of school climate committee, and more mentor/mentee programs, to name a few.	A, P

Rapid school growth. Multiple new teachers. Maturing of the school.	**T**
Relational ministry	**T**
Relationship building, support of leadership	**T, L**
Same answers as previous question	**N**
School Choice	**D**
School Climate and Culture notably correlated with Startup of FIRST robotics team	**P**
School growth and finding teachers who can cover curricular materials in a qualified manner. Space in classrooms is tight; some overcrowding is becoming an issue.	**N**
See past answers.	**N**
See previous answers. Teacher and leader retention and quality are the major factors.	**T, L**
Sports, etc. are making it very tough for kids to be in other things other than club sports, etc.	**P**
Staff culture and changeover, more rigorous changes in all curriculum areas.	**T, P**
Strong and humble leadership, retention of teachers	**L, T**
Students are realizing that the teachers are trying hard to make learning more fun and exciting. Additionally, PLTW is challenging students to become better students and learners.	**T**
Students can get very stuck up that they are in stem	**N**
Students say they enjoy Science more than they did before PLTW.	**N**
Teachers and staff being passionate about serving student needs impacts culture and climate far more than curriculum can.	**T**
Teamwork between students has increased	**N**
The addition of a more rigorous course option in general would have done the same thing.	**N**
the faculty has worked hard to be positive and communicative with students and parents	**T**
The positive, draining challenge of delivering a comprehensive curriculum, as opposed to just college prep, with our academically strong and weak.	**N**
The students are proud of their accomplishments & are recognized.	**O**
There have been major shifts across all content areas to increase rigor and improve the accuracy of grading and assessment resulting in more serious-mindedness in students.	**Q**
There seems to be a hightened emphasis on test results and challenging class schedules overall. PLTW may be part of this trend.	**Q**
This culture change really only affects grades 7 & 8, but their attitude toward some learning is definitely improved.	**N**
Voucher program, new administrative structure	**L, V**
We as teachers are focusing on helping children to be kind to each other which helps very much.	**T**
We have a brand new building and enrollment is up over 50 students from two years ago. Lots of positive energy in the teachers and parents.	**O**

We have accepted students into our special needs and a few students from public schools. I feel that our culture has take a hit with behavior and being courteous at times.	**D**
We have an increase in students who come from a "non-tool" background.	**D**
We have been intentional about communicating the Christian values of our school and helping students to discuss how they live out those values. This work starts with understanding what Christ has done for us and how we can show our gratitude by living for him and loving our neighbor.	**C**
We have had new teachers. We have also focused more on culture and climate recently as a school as whole.	**T**
We have made a concerted effort to deal with discipline issues in such a way that climate and culture aren't negatively affected. Dealing with discipline issues fairly, consistently, and immediately all help to improve climate and culture.	**M**
We remove the trouble students faster.	**M**
WELSSA Accreditation, becoming a Wisconsin Parental Choice school (no new students enrolled to date, however)	**N**

Appendix G: Quantitative Cross-Sectional Trends Data for Climate & Culture

CULTURE

PLTW Teachers			
0	59	0%	Drastic Improvement
36	59	61%	Moderate Improvement
22	59	37%	No Change
1	59	2%	Moderate Decline
0	59	0%	Drastic Decline

Grade School			
1	119	1%	Drastic Improvement
58	119	49%	Moderate Improvement
59	119	50%	No Change
1	119	1%	Moderate Decline
0	119	0%	Drastic Decline

Principals			
2	30	7%	Drastic Improvement
17	30	57%	Moderate Improvement
11	30	37%	No Change
0	30	0%	Moderate Decline
0	30	0%	Drastic Decline

High School			
4	153	3%	Drastic Improvement
74	153	48%	Moderate Improvement
72	153	47%	No Change
2	153	1%	Moderate Decline
1	153	1%	Drastic Decline

Non-PLTW teacher			
2	159	1%	Drastic Improvement
72	159	45%	Moderate Improvement
83	159	52%	No Change
2	159	1%	Moderate Decline
0	159	0%	Drastic Decline

Appendix H: Qualitative Data for Teacher Satisfaction and Team Morale

If there has been a significant change in teacher satisfaction and/or team morale, what other factors besides PLTW implementation may have caused this?	
A narrow mindedness on how PLTW can benefit and play a role in other academia throughout the school.	**R**
A refocus locally on our core values	**O**
Administrative actions and the quality of the administration team	**S**
After Gr K-3 took the PLTW course, I could better understand a new way of teaching science & how the same process would be taught throughout the other grades. I saw a similar change in teacher satisfaction when our FVL grade schools began studying together with our same grade level.	**C**
Again, hard to answer, haven't been here long enough.	**N**
Again, there has been a bit of teacher changeover that may have caused teachers to work together better. Our K-5 uses Launch, but as the science teacher, I am the only one using Gateway. If there were others using Gateway, I'm sure there would be more of us working together.	**S**
balanced work schedule, action based on teacher input, changes that are directly data driven and monitored by data	**W**
Building of a new school	**B**
Change in Administration, Building project, lack of inter-faculty contact	**S, B, R**
change in adminstration	**S**
Change in principal	**S**
Enrollment growth and the emergence of MAP. MAP has provided the team to join together to meet school growth goals. Everyone gets to participate. PLTW has definitely created a strong team effort and sense of pride in the programs among most.	**C**
FVL Schools Science curriculum study/update	**C**
Has gotten in the way of kids being able to take fine arts classes	**W**
I don't know any PLTW implementation	**N**
I question if there can be any correlation between the two here again (as was my concern in the past question). Seems too distant to correlate teacher satisfaction and team morale with an instructional resource. Far fetched in my mind.	**N**
I think sometimes other departments can get looked over "not important unless it's stem"	**R**
I've noticed some frustration with staffing needs due to PLTW.	**S**
In the science curriculum, the certification of PLTW teachers has taken them out of teaching traditional curriculum. While some other curricular areas are starting co-teaching classes, science has not implemented this co-teaching yet. Space for PLTW has taken 2 classrooms of space, which placed Physics in a Chemistry lab which is NOT designed to do Physics labs. Schedule software abilities are not used to build schedules that use our school's resources to	**S**

the best fit for classes, teachers, and room space.	
Increased emphasis on "Trades and Tools Education".	**O**
It has provided opportunity for teachers to work across the curriculum	**C**
Leadership in our school has changed and the role of our administrator has changed from part time to full-time	**S**
Major change in Administration	**S**
My 3-5 grade teachers are willing to implement Launch!	**N**
New faculty added	**S**
New PLTW classrooms	**B**
Our Bible studies with the Ministry Team.	**R, G**
Our K-6 teachers have not had to work as a collective group in a curriculum area in the past to the extent that PLTW offers. The downsizing of our faculty recently has had a negative impact on the teacher satisfaction and morale. Needing to build/rebuild working relationships will be beneficial. Hopefully, others will take notice of the team morale as well.	**S**
Perhaps it has been a change in the administration at our school which has also been a contributing factor, but the most significant one is PTLW and STEM.	**S**
Personalities of those on staff	**R**
PLTW has improved satisfaction for the science teachers but is not a major factor in this regard. The school is so big (900) that most staff aren't impacted by it at all.	**N**
PLTW implementation has caused a "haves verses have nots" relationship amongst the faculty with the PLTW being the haves and everyone else being the have nots.	**R**
PLTW is currently a stand alone 7/8 grade STEM plan. It really does not affect any of the rest of us.	**N**
Relational ministry -- developing relationships with co-workers, students, parents, community members, etc.	**R**
Restructuring/reorganizing classroom structures	**W**
Retention of teachers, experience of teachers	**S**
Significant leadership change without clear direction (until this year)	**S**
Slightly because of the funding aspect	**F**
Some other classes have smaller size because only so many classes can be taken in a semester	**A**
Staffing shifts and changes	**S**
Teachers work in teams within departments. STEM team is on fire for PLTW! There is a level of tension amongst all departments and other groups for limited resources. Governance makes the call.	**F**
The biggest impact on morale in our setting is the communication and sharing of God's Word with each other. Still, initiatives like PLTW create a perception and awareness of moving forward and improving our school, which fosters positivity.	**R, G**

The ideas of PLTW have motivated the staff, but the prep work and background needed to implement has taken time away from many other things.	W
The improved teamwork comes from our professional development days and not from the PLTW prgram.	R, C
The startup of a FIRST robotics team plays a much more significant role than PLTW or any coursework	O
The students are proud of their accomplishments & are recognized publicly.	A
The teaching is departmentalized, and there has been little impact on the overall morale or satisfaction.	N
This confuses me as I am totally unaware as to how PLTW is a factor in morale.I will share a morale issue is that some lack of confidence in the leadership focus of our president. He doesn't show much interest in understanding with the teachers in the trenches in decision making. This is NOT true of other administrators. There exists a frenetic pace of initiatives that teachers struggle faithfully to keep up with as they balance ministry and family.	S
We are all excited about the potential this program can bring for student development	C
We are providing students hands on science learning opportunities that will prepare them to lead in a Christ like way in high schools they attend	C, G
We have added a new science teacher and dean; being more departmentalized and having stronger leader are factors.	S
We have had some budgetary struggles over the last several years which would contribute to teacher satisfaction issues	F
We have looked at the overall rigor of course selections more earnestly and analyzed its effect on the overall preparation for post high school preparation. This has also brought to light the need for us to not lose focus on our Fine Arts programs. We want students to be in Fine Arts, and some have considered dropping certain Fine Art programs citing the need to take more courses of rigor. While at first somewhat contentious, it has caused Administration to consider the overall program we want our students to experience and be a part of.	A
We need time for professional development. Time to better use technology in our classrooms with students.	C
We we able to team teach PLTW with 3-4 grade which is awesome. I think that is a huge benefit to both teachers.	R, C
Years of work have been done to achieve this so it is hard to credit PLTW with an accurate proportion.	N

Please share any other insight regarding teacher satisfaction and/or team morale that might be beneficial to this study:	
Again, any type of dissatisfaction or team spirit has to do with the intense competition for students in all the programs and initiatives that exist in a school. In the end there are just so many students to go around and we all want them. Something has to give eventually.	C

As a K5 teacher, I feel that the materials for my level are very poorly written. This has caused me to rewrite the lesson plans. PLTW was billed as a ready-to-teach curriculum. That has not been at my experience at all. also feel that the modules take too much time out of my science block during the year and I must limit other science units that I have taught previously.	F
As I teach Kindergarten on a different campus from where these courses are taught, this is difficult to gauge.	N
At my high school, only two teachers actually teach a PLTW course. These two people have had to work together more as a team than they did when PLTW courses were not taught at our high school.	T
Because of the project based nature of PLTW, I am WAY more interested in what is happening in the science classroom than I would be normally. It has also pushed me to consider how I could used project-based learning in my own academic discipline.	I
Because PLTW did not cover ALL the standards in my grade, I have to supplement it or, as I did this year, I used MY PLTW unit as a supplement to the Science course set up through FVL Schools.	F
Being an FRC mentor is akin to being a coach. Perhaps more in some ways.	A
Change in focus and accountability has also played a role in this.	A
Departmentalization can carry risks of teachers being in their own element, but teachers split between several departments may experience difficulty in stretching themselves too thinly.	W
Faculty who care greatly about students, have a difficult time watching them make impossible decisions due to unnecessary schedule conflicts.	C
Generally speaking, teachers work in more isolation with little interaction daily due to heavy teaching loads. With homeroom and study hall supervision, full load teachers only have 1 free period at the high school and middle school level.	W
Having taught middle school Earth Science and Life Science every other year in a departmentalized setting, which at the time was 12 years, I was finding that my teaching of those two courses was becoming stale. After gaining approval for and then implementing PLTW Gateway courses in 2017, I found that my overall satisfaction for teaching the other two courses improved. My PLTW training allowed me to bring some fresh ideas and aplications to the Earth and Life Science courses I also teach.	I
I am the 5/6 science teacher and I know that students like it because they come back and tell me. I know my students are looking forward to it.	E
I am the senior science teacher and was asked about becoming a PLTW teacher. I could have but then They would need to call for a new science teacher. I don't feel the staffing needs are being met correctly.	W
I believe PLTW would be more effective and better received by students if it were incorporated into the math/science curriculum and counted for core credit. We currently have it separated out of these areas and included in our Trade and Technology Dept. so it does not count for core credit.	A
I believe that social studies is taking a backseat to stem and this will have a negative impact in the long run on our country	O

I do not diretly benifit from PLTW nor have I heard muxh about how it is being used in our high school.	**N**
I don't teach it and know almost nothing about PTLW.	**N**
I enjoy teaching the modules and love to see the student excitement for the program.	**E**
I feel a need to clarify this response. I feel that the educators involved in teaching PLTW have developed into a very cohesive team that works together to accomplish a common purpose to the program. While I believe that the faculty overall has received the PLTW program well, that is not universally the case. I think in the case of those who don't view it as a positive thing within our building, they have not been communicated with properly to help them see the positive impact programs like this can have in our schools and synod. This probably goes back an unclear vision that was cast by administration as this program was implemented. It can be extremely disheartening to know that you have teammates like this view you and what you do with a significant level of animosity and I am not sure at this point how to rectify that with them.	**Z**
I feel that teachers feel more powerful and impactful in the classroom because they have a strong program and curriculum to use.	**I**
I have a very supportive faculty, but since I am new to the school this year, I don't know if there has been a significant change in teamwork since we implemented PLTW. Two of our teachers who taught some PLTW modules last year have been good sources for me to ask questions and get advice. But I have also enjoyed being able to link arms with administrators and teachers outside of my school, asking for their expertise, advice, and help as I teach these modules.	**N**
I have always felt that the teacher satisfaction and morale was high; however, STEM education has given common language, goals, and communication, especially among our science and math teachers. There is a sense of pride in the projects that all students, 6-12, take part in.	**I, Z**
I like how it forces the children to work together and collaborate as a team.	**E**
I teach in the religion department. PLTW has had little impact on our department. That is not a criticism of the PLTW program. It's the reality of two vary different disciplines. I believe that the PLTW curriculum has provided a number of our students opportunities they would otherwise not have had.	**N**
I think a change in faculty and staff brings new life to the team.	**A**
I think teaching science is difficult when you have to purchase all the stuff you need. This is why grade school science teachers usually don't do a very good job. When you have a kit it really gives the teacher no excuse for not doing hands on activities.	**I**
In a high school, when someone wants to add classes to the course list, the question arises, "who will teach these courses? " Someone has to teach the courses and there are two outcomes; 1) the duties are handled in house or 2) calls may be made. When handled in house, there is more tension because more work is added to the plate of the already overworked called workers.	**W**
Intentional effective communication and collaboration are important assets for promoting a positive environment.	**Z**
It has been positive.	**N**
It has helped with professional development for our team in this department.	**T**

It makes sense that our marketing an recruitment focus has shifted towards our PLTW STEM curriculum, since that is what separates us from other schools. However, I believe this added focus has made some non-PLTW teachers feel less valuable, even though their courses are the foundation of our 4-year curriculum plan.	**V**
Many of the teachers involved help each other solve problems and challenges that come up from time to time.	**C**
More collaboration might make it easier to implement.	**C**
New curriculum that gets students interested/excited helps student morale, which helps teacher morale	**E**
New programs (like PLTW) get the majority of press coverage, attention, funds, and administrative cooperation compared pre-existing programs.	**O**
Once teachers implement PLTW they tend to see classroom management becomes easier since students are engaged. This is exciting for teachers and I think it encourages them to become a more proactive teacher.	**E**
Other elective class get smaller (ex. Chior, band, art, . . .)	**C**
Our admin was understaffed last year and duties were being carried out by full time classroom teachers	**W**
Our staff grew stronger after our principal was called home to heaven in May of 2019.	**A**
Perhaps teacher teamwork has been impacted but since I am not a teacher of a PLTW course, I do not see the impact.	**N**
PLTW has a positive impact and is preparing students for the future... however PE, English, Math, languages, and art are very important too and sometimes take a backseat to the needs of PLTW.	**O**
PLTW is positive for us - kids are excited to learn in our elementary grades (K-5)	**E**
PLTW seems to be a trend that schools neeed to impliment in order to keep current with educational expectation. Overall the additional classes seem to be a possitive at our school.	**N**
PLTW teachers enjoy what they teach, and the students are also excited about it. Parents are too!	**E**
PLTW teachers work well together, but there is very little communication from their department and mine.	**Z**
PTLW and the newly implemented robotics club, along with programming club are primarily directed by the science dept. I assist where I can but that pretty much involves the faculty and my perspective of a minor impact at the school..	**N**
Since there is no option for "unknown" in the previous question, I will use this space to say that PLTW has been here during my entire time at this school. From what I gather, it's had a positive impact, but I don't know if I can call it substantial.	**N**
Since we are a larger high school and PLTW is just one part of our extensive curriculum, the impact of teaching PLTW is generally reserved for the 1 or 2 who are teaching it.	**N**
Software keeps improving	**N**
some feel that we "sell" PLTW more than we "sell" other important aspects of our school	**O**

Some teachers, particularly veteran teachers, are hesitant to buy into PLTW. It is intimidating and can be less structured than what they are used to in other curricula.	**I**
Somehow, the teachers overall see the positive influence of the project lead the way activities on their students. This makes the teachers more eager to teach the lessons. The children overall thoroughly enjoy the project lead the way activities and do not complain about doing them which helps the teachers to see the value of PLTW.	**E**
Student engagement in science/engineering is signifacantly up which definitely leads to higher satisfaction in work.	**E**
Students are better problem solvers and improved in Math skills	**E**
Teachers have had their entire teaching philosophies shifted due to the PLTW / STEM teaching model.	**I**
The consistency that PLTW offers is important for teacher satisfaction and/or team morale.	**I**
The K-6 faculty has held off on getting the first units started in this initial year. They will be unpacking and training together with the Launch units on January 15. One teacher has implemented the first Gateway module with the 7/8 class in the first semester.	**N**
The PLTW teacher no longer follows school procedure for adding new classes. Other new electives that were going to be offered had to be cancelled when he added his Engineering courses without following proper procedure for requesting to add a class.	**A**
the PLTW teacher works on skills that benefit students across the board- math and even ELA, because it fosters new ways of critically thinking	**I**
The primary impact comes in allowing staff members to pursue passions. Passionate teachers are ore engaged and engaging.	**I**
The project the students did at the end of our Sound & Light unit helped students become better problem solvers and team players.	**E**
The students get very excited each time we do any PLTW activities.	**E**
The teacher teaching PLTW has stated to me that he does not follow the curriculum. Since it is an elective that competes with other elective classes, scheduling has been difficult. The teacher is also the head of the department and does little to make sure that the required classes for graduation are following state standards as he spends his time on PLTW. Many students have dropped these classes or are only staying in them because their parents are making them. It's frustrating listening to them talk about the disorganization and confusion of the class, probably because the teacher is rewriting some of the curriculum and still claiming that it is PLTW.	**F**
The trade and technology component is, again, part of our comprehensive curriculum offering. I cannot say that the implementation has made any change at all.	**N**
There are some that are not happy with PLTW and the emphasis we place on it in marketing and talking points. The department that seems to be opposed is Fine Arts. They feel it is taking students away from their programs.	**C**
There are two of each grade level at my school. PLTW has allowed for us to work together through a hands-on curriculum verses just doing whatever we wanted to for science.	**T**

There may be some coordination and communication between teachers regarding the curriculum. Some teachers are more comfortable and excited about the curriculum than others.	**T**
This is only my second year here and PLTW was implemented before I arrived.	**N**
We already had a math/science faculty that worked well together.	**N**
We have had a chance to train together in PLTW which has brought us closer as a team.	**T**
We restructured our classrooms and grades to allow for an extra room used for STEM. This leads to more cooperation amongst the teachers as we all utilize the spare room for STEM (and other classes as well).	**T**
While overall I think there has been a positive impact, I think there is also a slight negative impact from some feeling that STEM is emphasized to the exclusion of other areas.	**O**
With adding PLTW, our science department has expanded, so science teachers actually interact with each other less now that we are further apart and each more specialized	**T**

Appendix I: Quantitative Cross-Sectional Trends Data for Teacher Satisfaction and Team Morale

SATISFACTION

PLTW Teachers			
27	59	46%	Major positive
29	59	49%	Minor positive
3	59	5%	No change
0	59	0%	Minor negative
0	59	0%	Major negative

Grade School			
30	119	25%	Major positive
51	119	43%	Minor positive
37	119	31%	No change
1	119	1%	Minor negative
0	119	0%	Major negative

Principals			
13	30	43%	Major positive
15	30	50%	Minor positive
2	30	7%	No change
0	30	0%	Minor negative
0	30	0%	Major negative

High School			
34	153	22%	Major positive
50	153	33%	Minor positive
56	153	37%	No change
11	153	7%	Minor negative
2	153	1%	Major negative

Non-PLTW teacher			
22	159	14%	Major positive
53	159	33%	Minor positive
72	159	45%	No change
11	159	7%	Minor negative
1	159	1%	Major negative

TEAMWORK

PLTW Teachers			
1	59	2%	Major positive
30	59	51%	Minor positive
25	59	42%	No change
3	59	5%	Minor negative
0	59	0%	Major negative

Grade School			
3	119	3%	Major positive
57	119	48%	Minor positive
57	119	48%	No change
2	119	2%	Minor negative
0	119	0%	Major negative

Principals			
4	30	13%	Major positive
11	30	37%	Minor positive
15	30	50%	No change
0	30	0%	Minor negative
0	30	0%	Major negative

High School			
7	153	5%	Major positive
35	153	23%	Minor positive
93	153	61%	No change
16	153	10%	Minor negative
2	153	1%	Major negative

Non-PLTW teacher			
4	159	3%	Major positive
44	159	28%	Minor positive
96	159	60%	No change
14	159	9%	Minor negative
0	159	0%	Major negative

Appendix J: Qualitative Data for Marketing/Recruitment

Please share any other insight regarding marketing/recruiting that might be beneficial to this study:
FoxConn has been an important influence - mainly we are working to prepare students for this coming Industry to our area.
If a school wants to reach into the community, it has to work to make its environment to be welcoming to students of all faith backgrounds.
Our marketing and recruitment is pretty robust all around.
Parents do like their students doing hands on science
PLTW has been a great thing to market as we are the only school in the area that has all three pathways built out four years. It has created a new and very distinguished "unique".
We are eager to see how the PLTW experiences will start conversations or lead to inquiries as our marketing and recruiting begins for the new school year.

If there has been a significant change in marketing/recruiting, what other factors besides PLTW implementation may have caused this?
Again, the other programming/course additions.
Climate, entire curriculum, staff, extra-curriculars, transportation, faith-based
Free tuition
Governance commitment to marketing
Hiring a marketing/communication consultant.
In many ways our Administration sees PLTW as a flagship program that sets us apart.
Our school-wide approach to being open to non-WELS, non-Christian students including students from other denominations.
PLTW is nice to say on tours, but most people haven't heard of it.
See previous comment
There will be an effort in the near future to market our STEM curriculum due to our new building and STEM classroom. Unfortunately, I have no answers that apply now.
We have had numerous tours, stories, and visits all of which have focused on our PLTW program

Appendix K: Quantitative Cross-Sectional Trends Data for Marketing/Recruitment

MARKETING / RECRUITMENT

Grade School Administrators			
1	14	7%	Major positive
6	14	43%	Minor positive
7	14	50%	No impact
0	14	0%	Minor negative
0	14	0%	Major negative

High School Administrators			
3	16	19%	Major positive
11	16	69%	Minor positive
2	16	13%	No impact
0	16	0%	Minor negative
0	16	0%	Major negative

Appendix L: Qualitative Data for Enrollment

Please share any other insight regarding enrollment that might be beneficial to this study:
Families who have changed their enrollments to local public schools have commented that they will have greater options for advanced or alternative classes, more student peers to enhance social growth, access to daily band time, greater foreign language experiences, and better options and coaching with athletics teams.
It is critical to have parents perceive your Lutheran high school as the best place to be prepared for college or career, which from a Christian perspective includes strengthening faith to endure the challenges and temptations that impact young adults.
Most of our students are from the community and most enrolling students were already students at DSA, but not necessarily WELS members.
Our community has really dictated our growth.
Our growth can't be pin-pointed to "mostly" one group, which is why I selected "none". As our LES numbers increase, then we will also increase our non-LES.
Our reputation has changed dramatically in the communities surrounding Shoreland. We are recognized for our PLTW programs.
Our school continues to be blessed with growth from a fast growing area but also our parents emphasizing the quality to other parents who consider enrolling their children.
PLTW is a way to sell your school only if you do it in a major way
We have experienced growth over the last three years in our MS, but it hasn't always led to growth at the HS. We have smaller classes coming to us from our area Lutheran elementary schools, while our graduating middle school kids are getting larger. For example, we will be graduating 36 8th-graders (mostly community kids) and it's looking like 34 of them will be moving to the HS. That will make up 33% of the freshman class--mostly joined by WELS kids from the area LESs. (I hope that makes sense)

If there has been a significant change in enrollment, what other factors besides PLTW implementation may have caused this?
Created a new position to target families (enrollment director)
General growth of community and our school's reputation.
Improved recruitment initiatives that span our PK-12 partnership with our LESs. Improved marketing and communication.
Intentional recruitment from our conference school. Focused marketing to strengthen awareness and perception of our schools successful outcomes.
Marketing.

Milwaukee and Wisconsin Parental Choice
Mount Lebanon is the only 5 star school for three years in a row on the north side of Milwaukee.
Our enrollment has not been affected by PLTW. We have not promoted this program. Our enrollment has grown for other reasons.
Our school hasn't stopped growing since 2004. A lot of it is circumstantial.
Our school is going through major growth of both WELS And community students (that wasn't an option above). Our school growth has come from MANY factors all working together to create a learning community and family that more and more people want to be involved in. Our mission is more focused, our school climate is richer, our morale is higher, etc. etc. All of these things are occurring. PLTW has been a blessing to us, but is one small cog in a large wheel. This is the reason for my hesitancy of correlating these high level factors with one small area of our education.
PLTW implementation has had nothing to do with the enrollment decline over the past 15 years.
School Choice
School Choice
We became a choice school
We have and have had long waiting lists. Enrollment is only impacted by the number of classrooms and teachers available.
We have had minor growth due to other strong schools in our area
We purposefully recruit students from our community and from around the world.

Appendix M: Quantitative Cross-Sectional Trends Data for Enrollment

ENROLLMENT

Grade School Administrators			
1	14	7%	Major Growth
3	14	21%	Minor Growth
10	14	71%	No Change
0	14	0%	Minor Decline
0	14	0%	Major Decline

Grade School Administrators			
1	14	7%	Growing - mostly WELS
8	14	57%	Growing - mostly community
4	14	29%	n/a
1	14	7%	Declining - mostly WELS
0	14	0%	Declining - mostly community

High School Administrators			
0	16	0%	Major Growth
11	16	69%	Minor Growth
5	16	31%	No Change
0	16	0%	Minor Decline
0	16	0%	Major Decline

High School Administrators			
3	16	19%	Growing - mostly WELS
6	16	38%	Growing - mostly community
6	16	38%	n/a
1	16	6%	Declining - mostly WELS
0	16	0%	Declining - mostly community

Appendix N: Qualitative Data for Standardized Test Scores

Please explain your response concerning *MATH* standardized test scores.
Can't attribute any growth or reduction to this specific change
Change to Engage New York and math facts automaticity.
I am not sure that we can specifically correlate our math standardized test scores with implementation of PLTW
I don't have enough data
I haven't run the numbers specific to PLTW years. However, our math scores are incredibly high already because of focused attention that we give to that specific subject.
I would have to research this more to give an accurate answer. This is not something I track in my department.
Just implemented PTLW this year and no testing to evaluate as of this survey.
MAP scores
More connectivity to complex thought processes and materials
More students from PLTW courses meet growth goals. They also score much higher on the ACT overall score.
Not able to tell
Not sure of the the results
Only a small percentage of students are involved in PLTW as it is one of many options
Our math scores are improving because of teacher retention and improved instruction in math. I am not aware of a correlation between PLTW and math scores.
Our school's standardized math scores have historically been very high. Seemingly, there has been no change.
PLTW engineering is applied math. Performance of students is 3 and 4 times what is typically observed.
PLTW is a practical way for students to engage with math concepts. This coupled with our data driven instruction has caused students to grow in math.
Testing has not yet occurred since a PLTW unit was completed.
The test scores have remained about the same.
to soon to tell
We do not have data that demonstrates that PLTW implementation has any causal relationship to math test score improvement. This is more likely due to intentional efforts to strengthen curriculum, instruction as informed by measures of achievement and growth.
We have had some extremely strong math students that recently graduated. We don't

have the strong math students coming into our upper grades.
We have not noticed a significant change connected to PLTW...ACT scores would be our barometer
We haven't seen any significant changes
We just implemented the STEM education and it too early to determine the affects.
We now use Zearn, Kahn Academy and small group interventions
We've always had pretty high scores in all areas. When scores are already high, it's difficult to have marked growth.

Please explain your response concerning _SCIENCE_ standardized test scores.
I don't have scores
Can't attribute any growth or reduction to this specific change
Consistent with other research.
Have not tracked this
I do not have data that demonstrates a change in this area of student achievement.
I don't have enough data to prove test scores either way.
I don't have knowledge of growth in Science.
I haven't run numbers.
No significant changes.
Not able to tell
not sure
Not sure of the the results
Not yet tested after implementation of PLTW
Our school's science scores increased before PLTW was implemented. Again, there has been little/if any change in recent years.
Overall test score averages are unique to each grade level. Students just in PLTW have not been pulled out to analyze them in math or science
Same answer as above
Same answer as before. We have not been tracking that.
Same as above.
See above
Testing has not yet occurred since a PLTW unit was completed. We also do not conduct science standardized tests for all students in a grade.
The PLTW allows our teachers to handle some of the standards that we were not

covering previously.
The standardized test data set has changed since we started doing PLTW so it is difficult to measure but we have seen minor science growth even though we cover much less in content and go far deeper into concepts than before.
This response should come from Pete Langebartels.
Too early to tell in the implementation process.
too soon to tell
We do not test Science
We have not tracked how, but scores have improved in all areas over the last three years with our focus on Math and ELA instruction.A

Please explain your response concerning *READING* standardized test scores.
Can't attribute any growth or reduction to this specific change
Consistent with other research.
ELA coaching and math and intentional inservicing for instructional and testing improvement.
Have not tracked
I do not have data that demonstrates a change in this area of student achievement.
I don't have enough data
I don't have knowledge of the reading scores.
I don't have scores
I haven't run numbers
interventions and data-driven instruction
Major increases, especially in MS. Nothing to do with PTLW.
No significant changes.
Not able to tell
not sure
Not sure of the the results
Our English curriculum has strongly impacted this.
Same answer as above
Same as above
Same as above.
same as before
see above

Testing has not yet occurred since a PLTW unit was completed.
The Reading test scores have remained about the same.
The standardized reading scores have been high with no discernible change since PLTW began.
To early to tell.
to soon to tell
We have grown in informational text reading which is a focus area of our school in ELA for PLTW
We have specific concerns in our reading curriculum that are not addressed by PLTW.

Appendix O: Quantitative Cross-Sectional Trends Data for Standardized Test Scores

MATH - Grade School Administrators			
2	14	14%	Major growth
2	14	14%	Minor growth
6	14	43%	No change
3	14	21%	n/a
1	14	7%	Minor decline
0	14	0%	Major decline

SCIENCE - Grade School Administrators			
0	14	0%	Major growth
4	14	29%	Minor growth
4	14	29%	No change
6	14	43%	n/a
0	14	0%	Minor decline
0	14	0%	Major decline

MATH - High School Administrators			
2	16	13%	Major growth
5	16	31%	Minor growth
4	16	25%	No change
5	16	31%	n/a
0	16	0%	Minor decline
0	16	0%	Major decline

SCIENCE - High School Administrators			
0	16	0%	Major growth
2	16	13%	Minor growth
5	16	31%	No change
9	16	56%	n/a
0	16	0%	Minor decline
0	16	0%	Major decline

READING - Grade School Administrators			
2	14	14%	Major growth
2	14	14%	Minor growth
6	14	43%	No change
4	14	29%	n/a
0	14	0%	Minor decline
0	14	0%	Major decline

READING - High School Administrators			
0	16	0%	Major growth
2	16	13%	Minor growth
5	16	31%	No change
9	16	56%	n/a
0	16	0%	Minor decline

| 0 | 16 | 0% | Major decline |

Appendix P: Qualitative Data for School-wide Curriculum

Please share any other insight regarding school-wide curriculum that might be beneficial to this study:	
Adaptation of different literacy approach in lower grades - centers, guided reading, etc.	**N**
Again, I must reiterate that the proper procedures for adding classes were not followed by our PLTW teacher. This meant that other pre-approved new electives were dropped. Therefore, the ONLY extracurricular options our students now have are Phy. Ed., foreign language, or (what feels like) a million science related classes. Several students and parents are very upset by this. Many students have interests in other content and were robbed of that opportunity because one person kept insisting that we add another engineering course (we already had one) for the few students who requested it. PLTW has made our curriculum completely unbalanced and is even disrupting the balance within the science curriculum itself.	**S**
As a general rule, the greater the number of courses offered, the fewer the number of students who will register for and take any given class. This applies to elective courses, not required courses.	**T**
As with any curriculum additions, the scheduling process can become more complex - especially when singleton courses have to be dealt with.	**S**
Because our faculty bought in to the need for more specific STEM offerings, implementation has not caused any significant changes to our curriculum.	**N**
Calling teachers to fit into other core subjects and not just for PLTW is needed. Some departments are also in need of teachers.	**T**
For impact: Having a club/outlet like a FIRST robotics Team takes precedence over formal coursework in Engineering. The "sport" leads to desire to learn more.	**A**
I am not against PLTW programs. However, I do have grave concern over what we are doing to our schools with the never-ending programs and initiatives we are placing before our students, faculties, and families.	**A**
I am not teaching my regular Science. I am only teaching PLTW. I feel my students may be missing out on other aspects of Science. For example my students are not learning the parts of a plant, the planets, simple machines, or the water cycle this year. These are things my students have learned in the past. I wonder if they are learning these in other levels of PLTW (I know the grade below me did Simple Machines in PLTW) or if it will have a negative impact on them down the road not learning these things.	**G**
I feel that the only ones at our school who really know anything about project lead the way are the stem teachers. Teachers not involved in Stem have never been approached about this.	**N**
I think it is important for programs who might be feeling slighted by all the focus on	**I**

PLTW to raise the level of the quality of their programs and see the need to promote them.	
I think the big challenge schools have to wrestle with is determining how PLTW does fit into their curriculum. Is it a replacement, an enhancement? I think our curriculum partners well with the advanced, honors, and AP courses that SL offers. It provides additional ways for students to explore and interact with rigorous materials, concepts, and experiences.	**H**
I took part in the PLTW Lead Teacher training this summer and they seemed to be working on standards yet....part of our work during training was to see where our curriculum and standards match up with the PLTW program. I felt a little overwhelmed when I returned to my school because not all of our standards were met using PLTW exclusively....yet that is what the program encourages.	**G, H**
In our setting, where PLTW courses have not replaced traditional courses, but rather are electives, scheduling is by far the biggest obstacle. Students sometimes need to make a choice to NOT enroll in something else if they want to be a part of our STEM Academy.	**S**
In the elementary we haven't implemented it because we don't have space in our curriculum. My understanding is that it only has been taught in the middle and high school.	**N**
In the elementary we haven't implemented it because we don't have space in our curriculum. My understanding is that it only has been taught in the middle and high school.	**N**
Interested to see what high schools need from 8th graders and if PTLW aligns with that	**A**
It's hard to schedule new electives, especially ones meant for a variety of grades. Otherwise it does not "fit in" with our science curriculum, it functions as an elective, like art or band. However, it its good to have electives for students, so it's nice to give them that chance, even though I personally think it's not being implemented well.	**S**
It's not a required class (in the high school), but a good number of students have elected at least one of the four offerings.	**N**
more project-based learning has been implemented by staff as well	**I**
Offering PLTW has led to a challenge to some students to fit everything they want to do into their schedule. Arts and music may be suffering because of this.	**S**
Our HS federation schools implemented FOSS this past summer following a curriculum study. We are limiting the amount of FOSS kits we adopt because of the PLTW materials we already have.	**A**
Our school is part of the FVL Federation and are part of the curriculum studies guided Mrs. Giddings. The federation approach to curriculum and professional learning communities has strengthened our teaching and shared ideas with fellow grade level teachers.	**A**
Our school needs to continue the process of filling in the gaps that PLTW does not	**G**

cover.	
PLTW allows us to provide a new category into our curriculum. Our school added to the curriculum instead of fitting PLTW into our pre-existing curriculum.	**H**
PLTW courses are excellent models for rigorous instruction.	**I**
PLTW has been a huge curriculum boost to our school and the implementation, while a challenge, has been a great benefit to our students and staff.	**N**
PLTW has sucked the oxygen out of the room and creates battles amongst the high school faculty for students. And with promises of weighted grades and college credit, it's nearly impossible for other programs to compete with that.	**S**
PLTW is a tool to deliver the curriculum. Any other program that delivers relevant educational opportunities would have similar impact.	**N**
PLTW is great but it needs to expand its kits to include more life and earth sciences.	**G**
PLTW is only used in grades 7-8 at this time.	**N**
Previous scheduling comments.	**S**
Scheduling is a challenge. Sometimes the arts/music get omitted by students because they can't fit them in.	**S**
Since I only teach PLTW courses in grades 7 & 8 and those courses are the middle school Gateway courses of Design and Model and Computer Science for Innovators and Makers, we simply eliminated the "computer" class period in the schedule and replaced it with these two PLTW courses. DM and CSIM are taught in a two-year cycle. Due to numbers of students, we always divide our grades 7 & 8 students into three mixed 7 & 8 sections with each section having roughly 20-25 students. Each section is taught one 45 minute period PLTW course every three days. This means an entire PLTW course will run from September through the end of February or beginning of March. Not ideal, but it works for our setting. This has not impacted any other grades/curriculum.	**N**
some departments feel like their numbers went down due to PLTW offerings	**S**
STEM is necessary in today's rapidly developing world. It's either get on board or be left behind - in my opinion.	**N**
Students taking engineering classes have had scheduling issues because of the speciality courses only being taught by one or two people and only having one section of the courses.	**S**
Teacher turn over in WELS schools makes for a challenge and training new teachers for AP and PLTW.	**A**
The addition of a niche curriculum has slowed the potential change in some curricular areas because it has a staffing impact for a relatively small number of students. We must devote a teacher to those courses which limits their ability to teach other core courses.	**T**
The biggest deterrent is cost of training and materials. This can be difficult to do depending on number of teachers needing to be trained and the amount of	**A**

materials to satisfy the number of students.	
The challenge in implementing PLTW is time -- some activities take quite a bit of time and can't always be put away to finish another day, and the other issue is sharing the vex kits required for some of the units.	**S, M**
The challenge with implementing PLTW was needing more teachers to teach more classes.	**T**
The enrollment in other noncore classes is affected and goes down slightly when new classes are introduced	**S**
The modules require a lot of time, so it has been a challenge trying to take the PLTW timeline for modules and lessons and fit them into our schedule. I only have 35 minutes for Science, so it has been a challenge for me to figure out how long projects will take, what projects I will need to skip over or cut out completely, etc. Another challenge that came up at the beginning of the school year was materials. The grant we received wasn't going to cover all the materials I would need to implement all the modules my school wanted. Thankfully, we were able to borrow equipment from another school that has also implemented PLTW, but in the future, our school will need to figure out how we will be able to afford all of our own equipment. Finally, only our middle school campus uses PLTW. One challenged I faced at the beginning of the school year was getting my 5th grade students to work in groups and not rely so much on me for help as they worked through different projects. Even though I've been using the PLTW curriculum so far this year, I still have students who have difficulty trying to become independent learners.	**S, M**
The PLTW courses are Electives which means kids have to sometimes make choices between taking PLTW courses and other disciplines such as art and music.	**S**
The students that are enrolled in our PLTW course as an elective seem to enjoy it, but the course has somewhat of a reputation for being for the lower-achieving students.	**A**
The time needed for PLTW right away to get all things in was a challenge for many teachers in self-contained classrooms.	**S**
There is an impact any time a school adds new courses. The biggest negative impact that I see is on the fine arts department. Choir & band directors have to be included in the conversation. FVL has added a summer phy/ed class option and has also allowed a co-curricular to count as a phy/ed credit. That type of flexibility is important.	**S**
Though the PLTW curriculum is comprehensive in its scope, it would be nice if they were offered as semesters instead of full year courses. This would allow more students the opportunity to take them. Instead many of our current electives are year courses including PLTW, which has suppressed the course enrollment.	**S**
Time for Science, in my K. classroom has been increased significantly. It took me 12 weeks to teach one Foss unit. I have to add a second Foss unit next year and a third the following year! What will I have to give up?	**N**

Value of what PLTW gives overcomes whatever is lost from traditional curriculum	**N**
We are an FVL school. This year they suggested the use of FOSS kits for Science. There were a few items I still used from PLTW.	**N**
We are in year 3 of an all course curriculum update to meet needs of 21st century. The work is arduous, but is shifting how we deliver courses and assess success in addition to bringing relevance to all courses. PLTW is a good fit for 21s t century leraners	**A**
We are studying the science/STEM curriculum this year. We also were able to move all of our science supplies back into our school building which will allow all teachers easy access to usable resources.	**M**
We had also just changed our reading curriculum so that was two big shifts in the span of a year. Both were positive shifts.	**N**
We have to really spend a great amount of thought and time to scheduling to make courses available. Tough in a small school with small staff.	**S**
Year 2 numbers seem to cut in half the number of students.	**N**

If there have been any significant changes in school-wide curriculum, what other factors besides PLTW implementation may have caused this?	
2nd year in. I teach CAD, Metals, Woods, Small Engines, Construction Trades, Ag Survey, etc. Yet to see if it changes my enrollment numbers.	**N**
Adaptation of new language arts and social studies curriculum as well.	**U**
Addition of AP courses	**P**
Again I am not aware of the PLTW factors.	**N**
Along with adding PLTW we have also added AP courses along with multiple entry points in math. I believe PLTW has helped us see that we needed add courses for students not wanting to pursue a 4 year college degree.	**P, U**
AP classes have bigger impact school wide	**P**
AP courses	**P**
Change in Math from Engage NY to Zearn	**U**
changes in enrollment numbers	**E**
Changes in society and in education forced us to make some changes to move forward with everyone else.	**N**
community professionals' willingness to teach some specific courses	**A**
Creating two additional classrooms as multi-grade rooms from four single grade classrooms has not really changed the curriculum. It has created changes to the curriculum implementation however. Teacher planning in K-6 for the year accounted for time to conduct the two Launch modules chosen for this first year.	**D**

Further refinement to curriculum and scheduling is expected as teacher's plan with a year's experience.	
crossing schedules between middle school and high school	S
Data digs	A
Departmentalization of the upper grades in the past year	D
Departments pursuing quality academics	A
Engage New York Math & Language Arts, IXL Math & Language Arts	U
FIRST robotics team has really been a positive academic and social influence	U
Fitting AP and PLTW into curriculum at the same time. School growth has been a factor.	E, P
Focus on Differentiation by the faculty	A
Focus on math, reading and writing curriculum.	U
FVL grade school curriculum studies with Melanie Giddings is a big factor of the new Science curriculum, one Foss unit at a time.	U
Having teachers that like to teach science and implementing more STEM curricula	A
I can only speak to the implementation of Gateway, but this has been an issue with grades 6-8 curriculum simply because our curriculum for science needs to be updated. Working with those two factors (curriculum that will be updated next year & adding PLTW) has made it a little interesting.	U
I have been forced to shorten or eliminate parts of my science curriculum that I feel are basic to K5 education.	N
In the upper grades it has been made easier due to departmentalization.	D
Increased course offerings to students without increased enrollment of students.	S
It has increased class offerings without an increase to our student numbers. Scheduling is more than a little difficult	S
Last February, our school received a grant to help improve our Science curriculum. I think the grant really helped our school afford our teachers to get the proper training and materials needed to implement the PLTW curriculum.	N
Limited instructional hours, needing to teach religion for a portion of the day, also fitting social studies into the day	S
Many College Courses	P
more trades classes	U
Not all grade levels participate at this time. To my knowledge, it is only 4th-8th	N
One-to-one devices, different curricula in English and Religion (in the MS)	U
Other electives being offered	S
Other programs are not advertised or given the support...money given to them.	F
Our comprehensive curriculum is too expansive for a school our size. This has	S

resulted in many single sections of course offerings which causes many scheduling conflicts, including PLTW courses.	
PLTW along with STEM courses and both of their assumed necessity in their marketed approach to students have consumed all the available course expansion and student choices in a school of our size.	S
PLTW course have not all been filled. It has been hard to get mutltiple sections of the various courses and the senior capstone course has only had limited participation. Students have filled their schedule with more math, science and AP courses.	P, S
Restructuring grade levels (3 per room instead of 2)	D
school addition--STEM room	F
Significant investments in equipment and facilities were made to effectively integrate PLTW into our curriculum.	F
Students are taking additional Science courses. We have also added a successful Robotics program.	U
The push to market our school as all things to all men and providing marketable success stories supported by data.	A
The school offers a variety of courses online through ALHSO and a few select outside sources. This has greatly expanded course offerings available to students.	S
To see that all areas of our curriculum in our departmentalization of grades 6-8 continue to be at the highest quality.	A
We are finding that our students, once they reach high school are not always prepared for high school science, in that they need to know much more than just what PLTW will teach them.	N
We do have a new dean of academics who is accountable for planning, mapping, feedbacking, and reviewing curriculum. It has resulted in a coherent effort among all the faculty to make our curriculum the best it can be.	U
We eliminated a quarter worth of units in Middle school and two units from Elementary	N
We have created a new class into our curriculum. However, I see PLTW taking over our science curriculum in our school.	U
We have focused on implementing STEM strategies in our science curriculums. in	N
we have more variety in electives	S
We have provided opportunities for students with interests in engineering, but we still lack offerings for students not necessarily going to a four year college.	N
We have several initiatives to include Industrial Arts and a Business tract to our curriculum	U
We use both PLTW and Foss Kits. Our students are getting a well rounded science education.	N

Appendix Q: Quantitative Cross-Sectional Trends Data for School-wide Curriculum

CURRICULUM (Difficulty of Implementation)

PLTW Teachers			
5	59	8%	Major challenge
41	59	69%	Minor challenge
13	59	22%	No issue

Grade School			
12	119	10%	Major challenge
68	119	57%	Minor challenge
39	119	33%	No issue

Principals			
5	30	17%	Major challenge
16	30	53%	Minor challenge
9	30	30%	No issue

High School			
17	153	11%	Major challenge
90	153	59%	Minor challenge
46	153	30%	No issue

Non-PLTW teacher			
19	159	12%	Major challenge
90	159	57%	Minor challenge
50	159	31%	No issue

CURRICULUM (Value Added)

PLTW Teachers			
39	59	66%	Strong positive
17	59	29%	Somewhat positive
3	59	5%	Undecided
0	59	0%	Somewhat negative
0	59	0%	Strong negative

Grade School			
60	119	50%	Strong positive
36	119	30%	Somewhat positive
21	119	18%	Undecided
2	119	2%	Somewhat negative
0	119	0%	Strong negative

Principals			
21	30	70%	Strong positive
7	30	23%	Somewhat positive
1	30	3%	Undecided
1	30	3%	Somewhat negative
0	30	0%	Strong negative

High School			
64	153	42%	Strong positive
49	153	32%	Somewhat positive
30	153	20%	Undecided
8	153	5%	Somewhat negative
2	153	1%	Strong negative

Non-PLTW teacher			
56	159	35%	Strong positive
57	159	36%	Somewhat positive
35	159	22%	Undecided
9	159	6%	Somewhat negative
2	159	1%	Strong negative

Appendix R: Qualitative Data for Budget

If there has been a significant change in ministry budget, what other factors besides PLTW implementation may have caused this?
Addition of a variety of other programs to support SPED students.
Building project, training, equipment, time from investment of leadership to develop, implement and maintain the program.
Decreased ministry income combined with rising school operation costs
Donations to the program and student fees
increased enrollment
MANY!
Money has been allocated to various programs, so this is part of the expected cost of running programs - we did not try to secure additional outside funding
School Choice
School Choice funding and donors that will fund the gap between the cost of education and the Choice voucher amount.
We have made significant changes in our curriculum offernings in the last 15 years.

Please share any other insight regarding PLTW and budget that might be beneficial to this study:
Had to buy $6000 in computers using donations to implement software
I was wrong earlier. I didn't realize PLTW had as many life and earth science kits. I do not like the cost and time it takes to get trained. It is alot ot ask a school to have every teacher trained.
It costs about 100,000 per year which was not previously in the budget. This is out of a $10,000,000 budget.
PLTW has increased our budget significantly but has also allowed us to reach more donors who are willing to give to schools that look for new ways to reach more students with the gospel.
PLTW is important to implement and finding ways to make it work both in the budget and with outside sources of income are critical to getting students what they need.
Regardless of costs, we make a concerted effort to put forth the best academic program together for the students. Almost never does cost get in the way of doing what we feel is a benefit for the students.

Started budgeting for our STEM Lab and PTLW five years ago. Space, equipment, and curriculum cost us over $100,000 that we were able to fund through grants, third source income, congregational support, and donations.
Student fees seem to be a major factor
The implementation and funding were being planned two years in advance. We have also worked to use Title funding for training.
There are many companies that are willing to financially assist schools that are implementing STEM and PLTW curricula. Someone with a passion for STEM would be able to find extra dollars to help implement it.

Appendix S: Quantitative Cross-Sectional Trends Data for Budget

BUDGET

Grade School Administrators			
0	14	0%	Positive effect
8	14	57%	No effect
6	14	43%	Moderate negative effect
0	14	0%	Major negative effect

Grade School Administrators			
0	14	0%	Yes, fully
6	14	43%	Yes, partially
8	14	57%	No

High School Administrators			
1	16	6%	Positive effect
7	16	44%	No effect
7	16	44%	Moderate negative effect
1	16	6%	Major negative effect

High School Administrators			
1	16	6%	Yes, fully
9	16	56%	Yes, partially
6	16	38%	No

Grade School Administrators			
8	14	57%	Yes, major assistance
5	14	36%	Yes, minor assistance
1	14	7%	No

High School Administrators			
5	16	31%	Yes, major assistance
7	16	44%	Yes, minor assistance
4	16	25%	No

Appendix T: Qualitative Data for General Feedback

Do you have any other insight regarding the use of PLTW in WELS schools?
All WELS schools should implement PLTW
Anything that forces teachers and principals to re-assess what curricula are used is a good thing, and I believe PLTW at least forces the conversation of the value of adding new and challenging curricula for teachers and students.
As stated earlier, PLTW is a fine curriculum; however, because of the course length it limits students who are able to enroll. In addition, the course credits earned through PLTW also has limited value. Personally, as math department coordinator, I have been a strong supporter of PLTW,. It offers some awesome applications to math and science. My desire would be to be able to offer semester long PLTW courses. This would increase sections numbers and student enrollment.
builds team concept; uses gift of PLTW teacher
Exciting to be part of cutting edge developments in education, but also would like to see time and money spent on other core subjects and students who struggle academically and are unable to enter PLTW.
first time I have heard of it
Follow the history of the money that supplies PLTW, this will give you great insight into PLTW. You start out with a bias in your opening statement "only 9 of 28" Why include the "only". There are other options for STEM, STEAM, and engineering. PLTW is great, but not the only option. I do fear the old false push that "everyone had to go to college" to have a quality life, has now just changed into "everyone just needs to do STEM" to have a quality life.
From my experience, this curriculum is a benefit to students. It causes them to think critically in a way that most other courses do not. This is something that will benefit them in life, regardless of which occupation they pursue. It is also a curriculum that can be a benefit to the school ministry as a whole by setting it apart from neighboring schools.
Gives students who think mechanically and creatively a place to develop their talents in a meaningful way, leading to new and viable career options.
Good to have if they can fit it in.
Hand's-on, practical learning is GREAT! Adding "elective" classes while reducing the number of class hours is BAD! In a standards-based education world, why are classes that still teach to state standards (like PLTW) not eligible to count as part of the required coursework curriculum (i.e. Math or Science credit toward graduation). This is a no-brainer!

I am at a new school. My previous school did not use PLTW, and my current school does. I honestly am not familiar with the program at all so it is challenging me to answer these questions in a worthwhile manner.

I am excited to see what other options there might be for my level in the future.

I am still somewhat skeptical of the need for these courses. Are we following a fad in education to the detriment of giving students Christ centered; good well rounded "liberal arts" education.

I am very high on using PLTW in our curriculum and schools. It is an excellent program! The problem based/project based learning style is awesome! I highly recommend all of our high schools to start using it.

I believe PLTW is very beneficial to students. It prepares them to be thinkers and problem solvers which is what children of this generation struggle to do.

I believe that the business world is looking at Project Lead the Way as a way to have well trained workers in the future. The problem-solving that is done by the students is innovative and exciting to see.

I don't think so. As a parent, I appreciated that my children had the opportunity to take these courses. It was a significant "add' for them.

I enjoy teaching 2 modules a year in addition to my science units.

I feel it is a very good program that continues to improve. It definitely adds the the curriculum and skills that are lacking coming out of MLC

I feel that it has been a positive addition to our curriculum. I also feel that we as a school are in somewhat of a middle ground with its implementation - we use PLTW modules and a more traditional science text book driven curriculum. I would be curious as to how many other WELS elementary schools are similar or how many have fully invested into PLTW for their science curriculum.

I glad to see hands-on learning because not everyone learns by reading a book or listening to a lecture.

I have only been at my current school for 1 year, so my responses are not based on in-depth longitudinal experience

I hope and pray that the program is beneficial for students, because there has been a steep price paid by many others because of PLTW.

I hope to see MLC expand its preservice course offerings to include PLTW core training for students who may be interested in teaching these courses someday.

I love it! Amazing to see how the kids grow throughout the modules. They start looking to everyone for imput instead of the usual "smart" kids. They are taught to work in groups and work together for the best results. It is such a great "real-life" practice. Especially as Christians we want to show love and concern for others. I love that PLTW is able to encourage all learners in a non-threatening way. The groups figure out how to use everyones gifts in different ways.

I love that all the units are planned out for the teachers and can easily be modified to classroom needs. The students work together and learn to cooperate with one another.

PLTW meets grade level standards.
I personally think our students need to explore as many areas as they can at the high school level before narrowing the focus in college or tech schools.
I really like how it makes the kids think. I like how they have to work together. The children really enjoy it as well. I just wonder if they are missing things like I mentioned earlier in this survey.
I teach science, and I find a little frustration with PLTW/STEM in general as this type of course almost conflicts with my courses... I haven't been around long enough, though, to really have an opinion formed on the matter.
I think if more schools offered PLTW courses or related extra-curriculars, it would show parents that our curriculum is addressing contemporary workforce and social needs, in addition to staying true to our religious foundations. It would also give our students insights into a rapidly-growing field.
I think it is essential for WELS schools to use PLTW to elevate their standing in the community and federation/association. Brings many blessings to the school!
I think it is expensive to implement and other curricular ways would be more cost effective.
I think it is going to be hard to prove growth or decline in standardized test scores based upon implementing PLTW unless you are specifically targeting that information ahead of time.
I think PLTW has been a great addition for our school. The students get excited about it and I think it is fairly easy to implement as a teacher. I think it offers a great approach that gives students a more useful and practical way of learning. I love that it is very collaborative and more student-led with the teacher as a facilitator, as this adds to the enjoyment and learning for the students. (In reality, this is how we should be teaching regardless of what curriculum we use, but that doesn't always happen.) PLTW is organized and laid out in a way that helps teachers teach in a more innovative and effective way.   In addition, seeing what is being done at the high school level is very exciting as well. I think the variety of skills learned through PLTW better prepares any student for the future, whether they go into that field or not.
I think that being able to offer the classes is positive for us in the community / federation and the students that are enrolled in the courses. It's impact on course selection is still to be seen. Maybe we need to move from the the 8 period schedule.
I think to make it successful, it shouldn't be an elective, and certainly not one with an extra cost. Instead, it should be integrated into the core science classes while still covering the standards the school has chosen to follow. I could see the benefit of having a separate elective class for juniors and seniors once they've had an introduction in their freshman and sophomore classes to dive deeper, but to have it completely stand alone from the science core classes is a mystery to me.

I was involved in the decision to implement PLTW in my school, but not to the extent that I had to compare the PLTW curriculum to other STEM-based curriculums, so I cannot say how PLTW compares to other programs.
Involvement in PLTW is rather pricey; in fact, this aspect alone might explain why so few WELS schools currently participate in it.

I wasn't at St. Croix when they started PLTW. I see it as another elective option for students who are interested in exploring STEM stuff. I don't know that it's had a huge impact on students or curriculum, but it's great we can offer it!

I wish the athletes that I coach would spend more time working out in the off-season instead of working on their robots.

I'm afraid I don't know anything about PLTW besides its title. Now I'm curious, though! I'll ask my colleagues!

I'm happy for those that can fully specialize and utilize it. It's difficult in schools with 1 teacher teaching all subjects and multiple grades. Storage is another issue smaller schools have.

Is it a fad? I don't think so, but it smells like it

It allows WELS schools to compete with others in the area that also implement PLTW.

It can be a good thing, but is expensive and needs dedicated and well trained teachers to pull off a good implementation.

It definitely promotes thinking at a higher level. It offers cooperative and independent work to help problem solve.

It does take a major commitment in funding and teacher training to make it successful.

It is a good addition to the currirulum but grades K-4 only use module per year

It is a great hands-on learning opportunity for students to think critically, work together, and have fun while doing it.

It is a great resource that many students can benefit from when it is taught by a teacher who enjoys teaching the content - like any other subject area.

It is a much needed option for a school curriculum to stay up to speed with the changing social norms in the workplace.

It is not a bad thing at all, but it is being seen as a be-all-end-all and negating the importance of other content areas, namely ELA content. ELA skills are inherently and fundamentally more important for any student in terms of life or professional skills

It is very important and we need to do it to "keep up with the times". The future is technology and we are doing our students a disservice by staying away from it and out of the box problem solving.

It teaches them to work in groups and to problem solve on their own, plus it is ok to fail when problem solving

It was exciting and innovative the first year; but as I said, now I just implement it with my current science curriculum which meets all the standards for my grade.

It will be hard not to have a PLTW program and be regarded as an up to date school.

It's a great program, and attractive to parents looking at our school, especially since the local public school district does not offer PLTW.
It's very engaging and differentiates well with a variety of learning levels.
Like other AP classes, etc. - can't this just wait until college? Are our students really disadvantaged if they get there without it?
Make sure you have funding for this program
More if not all should be implementing this curriculum or something similar.
MORRE Students pursuing engineering and medical careers; higher student body regard for academics and sciences.
My experience shows that schools who implement PLTW intentionally always have positive experiences after working through the learning curve. It has become my observation that the reason so many of our schools, especially our LESs, do not implement PLTW is because of a lack of knowledge and a fear of the learning curve.
My kids both go to a WELS grade school that uses PLTW, I think it's beneficial to them and I'm glad they're part of it.
My wife taught and was trained with PLTW. I have seen the benefits of the curriculum first-hand. The training they give you is very well done, and it equips you well to teach the material. The content is student driven, and the students are challenged, but enjoy the hands-on experience.
Not only is there the concern about the curriculum being controlled by non-Christian companies, but also the heavy cost and time requirements for having teachers trained puts a burden on our continuing education budgets for all staff members, as well as making it difficult to call teachers already qualified to teach PLTW classes.
PLTW engages students. My 5th-6th graders struggle with completing tasks independently/with a partner. In teaching 5th-6th grade, I am in both PLTW Launch and PLTW Gateway. This presents challenges. I have choose to teach both 5th-6th grades together covering the modules over two years. Getting the training I needed was not easy process. The materials are expensive, but the curriculum works best when you buy the prepackaged kits rather than piece the materials together.
PLTW helps students learn to work together as a team to accomplish goals
PLTW is an excellent STEM program that engages students for 21st Century skills. It's expensive and requires highly trained teachers willing to work hard to learn how to teach a rigorous STEM curriculum. Parents are very interested in schools that provide STEM courses. Jobs of the future will involve STEM skills. Our school's mission statement is: 'Educating for Life and for Eternity'. PLTW curriculum fits the educating for life part of our mission statement well.
PLTW is fantastic in teaching students how to be problem solvers and responsible citizens. As with all curriculums, there are area that need suplementation, but the thinking skills taught are essential.

PLTW will work well in schools that have a person on staff that has a passion for STEM. This means that some schools will benefit until they lose their passionate staff member. I support the programs offered by PLTW, I would support more help from MLC. Ulitmately, schools should not pour dollars into the program unless there is a teacher with time and passion for it. This will be like many programs that are purchased and then sit on the shelf unused.
Really one of the best curricular changes we have made. Students love it and it changes the game.
Setting PLTW apart from the curriculum does not benefit the program or the other parts of the curriculum. It is a great thing for students to learn the trades, but they should not be considered an outside concept. Rather, doing all we can to use inclusive language regarding trades, fine arts, and practical arts ensures that our students see their value. An interesting angle to take would be considering the PLTW curriculum under the doctrine of vocation.
Some of the classes can be taken for college credit which impacts how long a student may have to attend a university or college.
Some of these are difficult to answer since we have just started the program. I am interested in the results. Thanks for your work.
Sorry to see such a low participation in this area but am glad to see WLS is at the front.
Students seem much more invested/engaged in their sciences classes than I have ever seen with other curriculums.
The students really enjoy it. I'm amazed at what they are able to do.
There are many students that come to WISCO because of this program. They get very excited to be a part of something that they feel strongly about.
These questions have been answered with the St. John's ministry in mind. In my previous calling we initiated K-6 Launch units. After one year, teacher satisfaction was high and the outlook for full K-8 implementation was strong. Since then, they have continued with the curriculum and the plan for expanding the curriculum opportunities.
Tough to fit in a school day.
Using the PLTW Computer Science curriculum makes sense because it does not scavenge the math / science curriculum for teachers. And WELS schools do not have any computer science curriculums in place from my experience.
We are blessed with teachers who love it, study it, and implement it in a way where their enthusiasm rubs off on the students.
We are piloting PLTW's new course Engineering Essentials this year. At this time we will be rotating our yearly offerings as well as adding adding a our own capstone engineering course next year
We found that although the PLTW helps for those who need direction or a startup, it is just as helpful for a skilled teacher to implement similar STEM components into coursework. And a few dozen grand less costs. Which can be spent on Tech tools for intended coursework. Also check out TPT for teacher developed STEM coursework at a fraction of PLTW costs.

We have completed 1 semester of our implementation of PLTW here at MLHS, so it is hard to tell of any affect yet to the culture of our school. At Shoreland, PLTW had a much greater impact on the school, we have yet to see that here. Depending on how much we implement, that may change.
We have only implemented it in our middle school and are now discussing it for our lower grades...can't speak about teaching it but have had a few conversations about it with the science teacher who has spoken very positively about it.
We love it. It provides us with a really strong curriculum.
When presenting and talking to WELS schools, they always bring up $$ as a hindrance to using PLTW
While the course is good, the level of understanding is difficult at times in lower grades.