Adoption of Technology Education Standards, In
District XYZ’s Middle School Technology
Education Program

by

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Abstract

Technology education has evolved into engineering and technology education. District XYZ is in the process of moving a skill based technology education program to a blend of skill and engineering based curriculum. District XYZ adopted Project Lead the Way into the high school and middle school curriculum. Project Lead the Way is a national program which involves the disciplines of technology, science, math, and literacy. This study identifies the technology standards used by Project Lead the Way and the process of adopting them into district XYZ.

Project Lead the Way uses the standards for technological literacy created by the International Technology and Engineering Educators Association. Standards and benchmarks are outlined in each of the units of the Project Lead the Way curriculum. A focus group was used to identify which standards would fit into the districts standards based grading system. The focus
group consisted of Technology education teachers and department heads. Findings from this study found agreement in three out of thirteen standards.
Acknowledgments

I want to dedicate this paper to my wife Elisa and daughter Addison. Your love and encouragement inspired me through the paper. My appreciation and thanks go to my graduate advisor, Dr. Katherine Lui. Without her intervention this project would never have been realized. My last thank you goes to everyone who supported me throughout the masters program and completion of the thesis.
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Chapter I: Introduction

Technology Education is a discipline in many public school districts across the United States. School districts offer a variety of technology education courses at both the middle and high school levels. Generally technology education courses are not part of the required curriculum instead an elective area. The five foundations of technology education are: manufacturing, construction, communication, transportation and energy.

A large district in the state of Wisconsin, district XYZ, has a technology education program in the middle and high schools. During the 2008-2009 school year district XYZ had a total enrollment of 10,374 students. District XYZ has two high schools, five middle schools and 16 elementary schools.

The technology education program in District XYZ is in all of the middle and high schools. Each middle school has four class offerings and each high school has 21 course offerings.

The curriculum at the middle school level in District XYZ revolves around the five foundations of technology and Project Lead the Way (PLTW). Each grade level offers some or all of the foundations and PLTW are covered. As the student goes through the progression of classes each foundation is explored in greater detail and more PLTW curriculum is covered.

Each grade specific class is broken down into quarter or semester long offerings. The sixth grade offering is a required nine week exploratory class. Seventh grade is one semester in length. Eighth grade offers two courses, problem solving and design and manufacturing; each one semester long. Part of the technology education middle school curriculum involves PLTW.

Project Lead the Way is a not for profit organization that develops curriculum that can be used in technology and science departments. The curriculum is centered on Science, Technology,
Engineering and Math (STEM) principles. PLTW uses a hands-on teaching model to develop a student’s critical thinking and problem solving skill.

PLTW has brought rigor to technology education curriculum. Science, Math, Literacy, and Technology standards are identified before each unit lesson in the curriculum. Standards ensure that what is covered in the curriculum is current and relevant to the discipline.

Curricular standards are generally written by experts in the field of study. The technology standards in the PLTW curriculum are the Standards for Technological Literacy. These standards were written by the International Technology and Engineering Educators Association (ITEEA).

Currently District XYZ’s middle school program is using the Wisconsin State Technology Standards. PLTW does not use the Wisconsin State Technology Standards. For the middle school program to adopt the PLTW curriculum the middle school technology program must adopt the Standards for Technological Literacy.

Statement of the Problem

District XYZ’s middle school technology education program must adopt the Standards for Technological Literacy to comply with the PLTW curriculum. A study is needed to identify which Technological Literacy standards are needed in the middle school Technology education program.

Purpose of the Study

The purpose of this study is to identify which Standards for Technological Literacy would be adopted by the middle school program. This study will determine the standards that will be used in each individual technology education classes.
Assumptions of the Study

It is assumed that District XYZ has not adopted the Standards of Technological Literacy. Another assumption is each individual class would have more standards than the standards in the PLTW curriculum. It is assumed middle schools have a traditional model including 6th, 7th and 8th grades.

Definition of Terms

Academic standards. Are broad expectations for school districts as to what should be taught to students in a given subject area (Pemberton, Rademacher, Tyler-Wood, Creijo, 2006).

Project lead the way (PLTW). Is a national program that has formed partnerships with public schools, colleges, and industry to increase the number of students going into engineering technology fields (Blais, Adelson, 1998).

STEM. A standards-based, meta-discipline residing at the school level where the areas of science, technology, engineering, and mathematics (STEM) are taught in an integrated approach (Brown, Brown, Reardon, & Merrill, 2011).

Technology Education. A study of technology, which provides an opportunity for students to learn about the processes and knowledge related to technology that are needed to solve problems and extend human capabilities (International Technology and Engineering Educators Association, 2000).

Academic benchmarks. Are the systematic breakdown and delivery of academic standards by a school district and its teachers (Pollock, 2007).
Limitations of the Study

Limitations of the study were limited to District XYZ’s Middle school technology education program and cannot be generalized beyond this population. The middle schools have a traditional model including 6th, 7th, and 8th grades.

Methodology

A focus group consisting of all middle school technology and engineering teachers and technology education department heads will be assigned the task of selecting the standards.
Chapter II: Literature Review

What this chapter will focus on is the evolution of technology education in the United States and its application at the middle school level. This chapter will also discuss academic standards and standards based grading.

History of Technology Education

Technology education has gone through many changes in the last several decades. Technology education has gone from being a skill based discipline based on craftsmanship to a cross between vocational skills and college preparatory course.

Technology education’s fundamental root’s are in skill based training and application (Bennett, 1937). This ideology dates back to the late 1800’s with prominent educators such as C.M. Woodward. In the early part of the 1900’s technology education was adopted into many high school’s curriculum. Students learned basic skills in high school which lead to job opportunities after graduation.

During the early part of the 1980’s there was a shift in public perception of college graduates out earning skilled based labors (Gray, 1996). This in-turn led to many students turning away from technology education and enrolling into college preparatory courses. At around the same time technology education was going through a reorganization as described by Snyder and Hales (1981). This reorganization changed technology educations focus from skill based to technology based curriculum. The International Technology and Engineering Educators Association released the standards for technological literacy in 2000. This document helped school districts create new programs to expand technological literacy in middle and high schools.
Project Lead the Way

As stated by Hughes (2006), PLTW was developed in upstate New York by Richard Blais. He began developing a pre-engineering curriculum for high schools during the early 1980’s. Richard worked with area technical colleges and local business to develop the pre-engineering program. In 1997 PLTW became a not for profit organization.

All of PLTW courses use an activity approach to allow students time to solidify their understanding of the content. All skills taught in a PLTW course can be applied in any of the STEM related fields. The three programs offered through PLTW are gateway to technology, pathways to engineering and biomedical sciences program. Gateway to technology is for middles school students. Pathways to engineering and biomedical sciences program are for high school students.

Gateway to technology consists of five different nine week classes: design and modeling, magic of electrons, science of technology, automation and robotics, and flight and space. PLTW requires districts to implement design and modeling and automation and robotics to become a certified PLTW school.

School districts must adhere to strict rules to be certified by PLTW. To become certified school districts must have PLTW trained teachers, business partnership teams, and offer all courses required for program completion. Teachers must be certified by PLTW to be able to teach the PLTW courses. Teacher training consists of 80 hours of classroom instruction on delivery of the PLTW curriculum over the course of the class. Training is done during the summer months and is broken into two week long classes. At the last class teachers are given a certificate of completion.
STEM

Science, technology, engineering and math (STEM) is a growing concern in the United States. The United States is focusing on increasing students test scores for each of the STEM areas (Reid, Feldhaus 2007). The ultimate goal for the nation is to increase the number of people going into STEM related careers.

STEM education is comprised of hands-on and critical thinking activities that are interrelated between the four disciplines. PLTW has aligned most of the curriculum with the STEM initiative. PLTW has intertwined many of the science, technology, math, and literacy standards into each of its units.

Middle School Electives

Most middle schools in the United States provide students with opportunities to enroll in elective courses. Elective course offerings come from subject areas other than science, social studies, mathematics and English language subject areas. This exploratory approach is supported by research done by Compton and Hawn (1993). The research found middle school students were at the right developmental stage to explore their likes and dislikes. Students in middle school need time to find their strengths and weaknesses in a variety of subject areas (Briggs 1920).

District XYZ Middle School Electives

Spanish, French, German, directed study, band, choir, orchestra, family and consumer education, physical education, technology education are all the elective courses offered at the middle school. The middle school requirements for each of the electives vary in length at each grade level. The current required exploratory courses for middle school students are in the sixth grade. Students are cycled through nine weeks of technology education, family and consumer
education, modern language, and art. Sixth grade students are also required to take one semester of physical education and one semester of the three offerings from music.

**Technology Education in District XYZ**

According to the Industrial Arts 6-12 “Internal Audit Report” (1981), the technology education program has been in District XYZ since 1926. Classes were taught at a local vocational school. Traditional courses of woodworking, metal working, printing and drafting were offered. Auto mechanics and electronics were added in the late 1950’s. Classes were taught by both high school and vocational teachers. During the late 1950’s District XYZ added exploratory courses at the junior high schools. The junior high schools offered woodworking and drafting. Boys were required to take technology education for one semester in grades 7 and 8. Technology education was an elective in 9th grade.

In 1961 District XYZ built a high school with classrooms fitted to teach traditional technology education courses of metalworking, woodworking, drafting, printing, automotive and electronics. A second high school was added in 1972. At the opening of the second high school grade level restructuring occurred in the district. Junior high schools became middle schools with grades 6, 7, and 8. The high school became four year school with grades 9, 10, 11, and 12.

For the next thirty years the technology education landscape did not change in District XYZ. In the last ten years the technology and engineering department has implemented PLTW into the district. PLTW is a pre-engineering curriculum designed at preparing students for a career in science, math, engineering or technology. All high schools and middle schools are now offering PLTW classes.
Middle School Technology Education Program

At the present time the technology education curriculum in the middle school level incorporates PLTW and the five foundations of technology education: construction, communication, manufacturing, transportation, and energy as described by Snyder and Hales (1981). As Foster (1994) states technology education can become a blend of the old skilled based curriculum and engineering based curriculum. In each of the technology education courses students are given a broader understanding of what makes up technology education. As each student goes through the curriculum the foundations are explored in greater detail.

Each grade specific class is broken into quarter or semester long offerings. The required sixth grade class is a total of nine weeks in length. Seventh grade is one full semester long offering. Eighth grade offers problem solving and design of one semester, and manufacturing of one semester, or a combination of both classes for a full school year.

Sixth grade curriculum consists of exploring: manufacturing, communication, and PLTW’s design and modeling, and automation and robotics. Each unit covered gives the students a base of understanding and a project to reinforce the concepts covered in the unit. The manufacturing unit focuses students on manufacturing principals, tool use, safety and project construction. Within the communication unit students are taught measurement and blue print reading. During design and modeling students explore drafting software by drawing solid model shapes. Automation and robotics lets students explore the worlds of automation and mechanisms.

Seventh grade curriculum consists of: manufacturing, design and modeling, and automation of robotics. As previously stated the unit gives the student a base of understanding and a project to reinforce the concepts covered in the unit. The manufacturing unit focuses students on manufacturing principals, hand and power tool use, safety and project construction.
During the design and modeling unit students broaden their use of the drafting software, and measurement. Automation and robotics gives students an understanding of how to automate process by building and programming simple machines to accomplish simple tasks.

The eighth grade manufacturing class curriculum consists of: communication and manufacturing, and the eighth grade problem solving and design class curriculum consists of: design and modeling, automation and robotics, and transportation. The manufacturing unit focuses students on manufacturing principals, materials, hand and power tool use, safety and project construction. During the design and modeling unit students experience 3-D computer aided design, measurement, and graphic arts. During the transportation unit concepts covered are modes of transportation, and propulsion. The automation and robotics unit broadens students understanding of how to automate process through building and programming simple machines to accomplish complex tasks.

**Standards**

Curricular standards are designed to give validity to what is taught in the classroom. Standards are typically written by experts in the field and are adopted by school districts. Luft, Brown, & Sutherin (2007) state standards are generally broad statements which are open to many interpretations. School districts curriculum departments and teachers work together to link grade level curriculum to the standards. Most states give a summative assessment to selected students to see if progress has been made toward the standards.

Technology education has many standards it can pick from in the state of Wisconsin. Technology departments can pick any list of recognized technology standards or combination of technology related standards. Currently no technology education standards are formally assessed at the state or national level.
Benchmarks

When standards are written they are generally broad statements. School districts with the help of curriculum departments and teachers must break down standards into benchmarks. As described by Pollack (2007) benchmarks are smaller formative assessments which when added up complete the larger standard. Benchmarks are used by teachers to outline goals for daily lesson plans. Students work is assessed on their completion of the benchmarks covered in the lesson.

Standards Based Grading


Standards based grading is a way to show a student’s progress toward mastery of a standard. Teachers align their daily curriculum with the standards approved by the school district. Students are then assessed on their growth toward the standards covered. Formative assessments are conducted throughout the year to show students their progress. Summative assessments are generally conducted every year.
Chapter III: Methodology

In 2010 District XYZ implemented PLTW at the middle school. As a result of the implementation much of the old curriculum was removed to make way for the PLTW curriculum. As the technology education department makes room for the new curriculum it has been decided to use the standards for technological literacy. PLTW does not use the current Wisconsin state standards which were outlined in the old curriculum. As our department makes the transition to PLTW it is beneficial to use the standards for technological literacy to accurately assess student achievement.

This chapter will outline the process the technology education department uses to select and adopt the standards for technological literacy at the middle school level.

Subject Selection and Description

All participants selected for the focus group must have taught all three middle school technology and engineering courses. Participants must have taught at one of the five middle schools in the district and still be employed by the district. Five of the seven focus group members are current middle school technology education teachers. Two of the seven focus group members are department heads and currently teach at the high school. Three of the five middle school technology education teachers travel to the high school to teach classes.

Data Collection Procedures

Qualitative data will be collected through the use of a focus group. The focus group will consist of 5 middle school technology education teachers and two technology education department heads. A series of six questions will be asked through the length of the meeting. The meeting will take place at a middle school in district XYZ. The meeting will take approximately one hour during the month of May.
Subjects will be asked to look through the curriculum for one selected technology and engineering course. Subjects will then be asked to see which of the standards of technological literacy they feel best fits the class. A series of 6 questions will be asked to determine if the standard will be adopted.

Focus Groups

Focus groups are designed to collect people’s responses to research questions (Lee & Nelson, 2006). The data collected from focus groups is called qualitative data or data that does not have a numerical value. The collected data is broken down into statements to look for reoccurring themes. The themes will determine if there are any preceded wants or needs.

The reason a focus group was chosen to collect data was to involve all stakeholders and get a better understanding of how they feel about the new standards. Within the small group members are able to bring up other issues related to the group’s purpose. Another reason to use a focus group is it is the best way to accurately gather the needed data. The data being collected is going to be used to determine if the selected standards for technological literacy will fit into the designated curriculum.

Data Analysis

The qualitative data was collected and recorded in a note book by the author. Data was collected by writing down respondent’s answers to prompted questions. Respondents were asked to clarify statements if they were unclear to the author. Some respondents were asked to restate answers and comments for completion recording of the recording process. The notes were then transcribed into a Microsoft Word document. Entries onto the Microsoft Word document were checked to make sure they were entered accurately.
The recorded data was gone over to find key points in the focus groups answers. When respondents were asked to answer questions, the answers varied. To accurately capture the focus groups responses the researcher categorized similar responses. The similar responses were broken down and categorized into common themes. These common themes were analyzed side by side to find out what was different in each response. After reading and analyzing each similar common theme the themes were then summed into one similar statement. The statement is then used to support or discount the findings of the author. Results are presented in detail in Chapter Four.

Limitations

Focus groups have a few flaws in them which can distort the data. One flaw is the focus group may not represent the total population. With this study the whole middle school department is included but participants could choose to opt out of the study. Another flaw is focus groups can become dominated by one or two members. A skilled moderator is needed in situation when this occurs. The last flaw is the data collection, analysis and results are based on one person.
Chapter IV: Results

The middle school technology education department in school district XYZ has adopted the PLTW curriculum. With the adoption of PLTW the technology education department must adopt the ITEA’s standards of technological literacy. To change over to the new standards the middle school technology department must approve each of the standards. A focus group was conducted to narrow the list of recommended standards set forth by PLTW. Each standard was discussed to find if it would be relevant for each class. This focus group looked at the sixth grade technology education course.

The meeting was held at a middle school in district XYZ. The meeting took place on May, 5th 2011. Four out of the seven focus group members were able to attend the meeting. The following is an analysis of each standard. Each standard covered is listed with a list of the questions and responses. Table one provides a synopsis of each standard followed by detailed analysis of each item.

Table 1

Answers to Focus Group Questions

<table>
<thead>
<tr>
<th>Standard</th>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
<th>Question 4</th>
<th>Question 5</th>
<th>Question 6</th>
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<td>No</td>
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**Item Analysis**

Standard 1: Students will develop an understanding of the characteristics and scope of technology.

1. How does the standard relate to District XYZs technology and engineering program?
   - Through the PLTW curriculum.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   - Does not, not distinctly related to the five disciplines.

3. Does this standard conflict with another newly adopted standard?
   - No, first standard looked at by group.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   - Yes, to many benchmarks under standard.
   - Conflicting information regarding appropriate number of benchmarks in a quarter class.
   - The group decided there was not enough time in the sixth grade course to teach all of the outlined standards and benchmarks.

5. Does the standard dictate how the curriculum should be taught?
   - No, standard is written vague as not to dictate curriculum.

6. Is the standard easily understood by the administration, teacher, student, and parent?
   - No, to vague.
   - Teachers discussed having trouble understanding standard.
Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

1. How does the standard relate to District XYZ’s technology and engineering program?
   • No, as a district the technology department does not go into technological literacy enough to use this standard.
   • Yes, teachers could filter through projects and show what technologies were created to help make them.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • No group members could find where this standard would fit appropriately.

3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • No, due to the short nine weeks of the class three benchmarks cannot be created and graded accurately.

5. Does the standard dictate how the curriculum should be taught?
   • No, vague enough framework to create curriculum.

6. Is the standard easily understood by the administration, teacher, student, and parent?
   • No, so vague it is hard to understand the standard and benchmarks.

Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology.

1. How does the standard relate to District XYZ’s technology and engineering program?
   • No, even with PLTW curriculum there is not enough time or exposure to this standard.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • The standard does relate to the five but do not have enough time to cover and grade accurately.

3. Does this standard conflict with another newly adopted standard?
• No, the standard does not conflict with any other standard looked at.
4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
  • No, not enough time to cover the standard.
5. Does the standard dictate how the curriculum should be taught?
  • No, standard is written vague as not to dictate curriculum.
6. Is the standard easily understood by the administration, teacher, student, and parent?
  • Yes, simply written the standard uses common language all groups use and understand.

Standard 6: Students will develop an understanding of the role of society in the development and use of technology.

1. How does the standard relate to District XYZs technology and engineering program?
   • Through the PLTW curriculum.
2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • Yes, peoples use of personal media in society today is explored in communication.
3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.
4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • Yes, there are enough benchmarks outlined in the PLTW curriculum to meet the criteria.
   • No, too few benchmarks apply to the 6th grade course.
5. Does the standard dictate how the curriculum should be taught?
   • No, standard is written vague as not to dictate curriculum.
6. Is the standard easily understood by the administration, teacher, student, and parent?
   • No, wording of standard is confusing for students.
   • Yes, students, parents, administration could figure out what the meaning of the standard is.
Standard 7: Students will develop an understanding of the influence of technology on history.

1. How does the standard relate to District XYZs technology and engineering program?
   • Yes, most teachers talk about how technology has helped change history.
   • Students have a hard time with worksheet lessons from PLTW curriculum.
   • Too many lessons in a very short amount of time.
2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • Teachers can vaguely apply the standard to all disciplines.
   • Teachers cannot necessarily grade this standard.
3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.
4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • No, not enough benchmarks can be created to justify standard.
5. Does the standard dictate how the curriculum should be taught?
   • No, standard is written vague as not to dictate curriculum.
6. Is the standard easily understood by the administration, teacher, student, and parent?
   • Yes, it is simple to understand.

Standard 8: Students will develop an understanding of the attributes of design.

1. How does the standard relate to District XYZs technology and engineering program?
   • Through the PLTW curriculum.
2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • Applies to all areas when students are creating projects.
3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.
4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • Yes, benchmarks will be built into grading rubric assessments.
5. Does the standard dictate how the curriculum should be taught?
• No, standard is written vague as not to dictate curriculum.

6. Is the standard easily understood by the administration, teacher, student, and parent?
• Yes, it is simple to understand.

Standard 9: Students will develop an understanding of engineering design.

1. How does the standard relate to District XYZs technology and engineering program?
   • Not all teachers cover the design process in the sixth grade technology education course.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • Applies to all areas when students are creating or fixing projects.

3. Does this standard conflict with another newly adopted standard?
   • No the standard does not conflict with any other standard looked at.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • Yes, the design process has many steps to evaluate.

5. Does the standard dictate how the curriculum should be taught?
   • No, standard is written vague as not to dictate curriculum.

6. Is the standard easily understood by the administration, teacher, student, and parent?
   • Yes, can be confusing when looking at other design process standards.

Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

1. How does the standard relate to District XYZs technology and engineering program?
   • Through the design process.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • Through the application of the design process in the five areas.
   • Each teacher does not identify all parts of the standard.

3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.
4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • Yes, according to the PLTW curriculum it should be covered.
   • No, teachers are not able to assess accurately. The standard is too specific in the design process and the class does not having enough time to cover content.

5. Does the standard dictate how the curriculum should be taught?
   • No, standard is written vague as not to dictate curriculum.

6. Is the standard easily understood by the administration, teacher, student, and parent?
   • Yes, very clearly written.

Standard 11: Students will develop abilities to apply the design process.

1. How does the standard relate to District XYZs technology and engineering program?
   • Through the teaching and creation of projects related to the design process.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • Not specified in any one discipline but the design process is in all disciplines.

3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • Yes, students projects will cover all of the design process steps.

5. Does the standard dictate how the curriculum should be taught?
   • No, standard is written vague as not to dictate what specific project to make.
   • Yes, the standard is written so that every step of the design process must be covered in the project.

6. Is the standard easily understood by the administration, teacher, student, and parent?
   • Yes, may be confusing to students and parents with earlier standards.

Standard 12: Students will develop the abilities to use and maintain technological products and systems.

1. How does the standard relate to District XYZs technology and engineering program?
   • When covering the design process.

2. How does the standard relate to the five disciplines of technology: transportation,
Standard 13: Students will develop the abilities to assess the impacts of products and systems.

1. How does the standard relate to District XYZs technology and engineering program?
   • No, the standard is not used in any of the middle school courses.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • Does not relate.
   • Yes, various trades use created measuring tools to measure items. The ideas are not covered in any of the middle school classes.

3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • No, not enough time to cover standard.

5. Does the standard dictate how the curriculum should be taught?
   • No, standard is written vague as not to dictate curriculum.

6. Is the standard easily understood by the administration, teacher, student, and parent?
   • No, you must have prior knowledge of the terms “technological products” and “technological systems”

Standard 16: Students will develop an understanding of and be able to select and use energy and power technologies.
1. How does the standard relate to District XYZs technology and engineering program?
   • Through the PLTW curriculum.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • No, energy is not covered in middle school.
   • Yes, energy can be meant as “ability to do work” which is covered under manufacturing, transportation, and energy.

3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • The standard can be lightly covered for a quarter class where the benchmark is on one worksheet.

5. Does the standard dictate how the curriculum should be taught?
   • Yes, the standard is specific at its end goal.
   • No, the process of teaching the content can be delivered any way the teacher sees fit.

6. Is the standard easily understood by the administration, teacher, student, and parent?
   • No, the standard and benchmarks do not line up and can get confusing for students and parents.

Standard 17: Students will develop an understanding of and be able to select and use information and communication technologies.

1. How does the standard relate to District XYZs technology and engineering program?
   • Yes, through working drawings and projects.

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?
   • This standard applies to all disciplines.

3. Does this standard conflict with another newly adopted standard?
   • No, the standard does not conflict with any other standard looked at.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks?
   • Yes, benchmarks are hit through multiple assessments.

5. Does the standard dictate how the curriculum should be taught?
• No, standard is written vague as not to dictate curriculum.

6. Is the standard easily understood by the administration, teacher, student, and parent?
• Yes, very simple to understand.
Chapter V: Discussion

The purpose of this study was to identify the process of adopting the standards of technological literacy in district XYZ. A focus group of technology education teachers was constructed to gather qualitative data. The focus group used a series of five questions to determine if a standard should qualify for adoption. Data was collected and generalized for each individual standard.

Based on the data not all standards will be adopted by district XYZ. Of all the standards looked at by the focus group only standards one, eight and seventeen were given general agreement on adoption. Standards concerning the design process nine, ten, eleven, and twelve are only covered by some teachers. The remaining standards three, four, six, seven, thirteen, and sixteen are not covered in a great detail. These differences in opinion on course standards are cause for discussion.

Limitations

The study is limited in many ways, the first being to one middle school program in the state of Wisconsin. The second limitation is the study is only focused on technology education. A third limitation is the use of the standards of technological literacy compiled by the ITEA.

The fourth limitation of the study is the use of focus groups. Not all focus group members were present for the meeting. This limited the study to a smaller audience. The fifth limitation is reporting of data can become skewed due to interpretation by the author.

Conclusions

The findings of the study align with some of the previous research on standards. Luft, Brown, & Sutherin (2007) article identifies how challenging adoption of standards can be. Since standards are written so general it becomes difficult for teachers to assess them accurately. Some
standards are broadly written like standard three and others are specific like standard eleven. With the variety of the standards language it became a challenge for educators to align the standards and benchmarks with the curriculum.

Another finding is the amount of standards and benchmarks present in the PLTW curriculum. Pollock (2006) states a course at the primary level in the applied arts should have 25 benchmarks over the course of a year. This statement would mean the technology education course would only have six benchmarks for the standards. The teachers must look at each standard and benchmark for PLTW to see if they can accurately assess and give feedback to students.

District XYZ’s technology education department focuses heavily on teaching students manual skills instead of technological literacy. This was described in the Industrial Arts 6-12 “Internal Audit Report” (1981). Almost half of the sixth grade course is made up of skill based instruction. The other half consists of PLTW curriculum. This discrepancy gets wider in seventh grade and wider yet in eighth grade.

Lastly, not all teachers are teaching the same curriculum. Some of the focus group members stated they did not teach the design process. PLTW curriculum covers the design process in many of its lessons. In the sixth grade curriculum the designated PLTW units cover the design process.

**Recommendations**

The first recommendation is getting all teachers to teach the same curricular units. As outlined earlier PLTW curricular units were placed in each grade level. All middle school technology teachers agreed on the PLTW curricular outline. This curricular outline must be brought up to the middle school teachers again as a reminder. The reminder should consist of the
PLTW curricular outline and a message stating the requirements set forth by PLTW. The second recommendation would be to report out the findings to the technology education department. This would aid in the selection of the standards for the remaining courses. The third recommendation is for further research on the effectiveness of using the standards for technological literacy in standards based grading.
References


Appendix A: *Focus group questions:*

1. How does the standard relate to District XYZ's technology and engineering program?

2. How does the standard relate to the five disciplines of technology: transportation, construction, manufacturing, communication and energy?

3. Does this standard conflict with another newly adopted standard? Describe your answer.

4. Is the standard able to be covered in the class through creation of 3 to 11 benchmarks? Describe your answer.

5. Does the standard dictate how the curriculum should be taught? Describe your answer.

6. Is the standard easily understood by the administration, teacher, student, and parent? Describe your answer.