THE EFFECTIVENESS OF THE MODULAR TECHNOLOGY LAB IN THE MOSINEE MIDDLE SCHOOL

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ABSTRACT

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Technology Education has taken on many faces over the last twenty years. Making a transition from the Manual Arts to Industrial Arts took nearly fifty years. However, the transition to education about technology evolved in as little as ten years. Brought about by the launch of Sputnik, American educators felt a need for students in the middle and secondary grades to not only learn how to work with their hands, but to understand the entire scope of technology from its need to its impact on societies and the environment. In short: to help create students who are technologists.

The School District of Mosinee, in the spring of 1994, developed a document whose purpose was to drive both curriculum decisions as well as educational purchases. Based on Cook's philosophy of strategic planning, the district set about ensuring that their new middle school Technology Education program met the litmus test of their strategic plan. That is, that the program be standards-based and student centered. In 1997, Mosinee purchased a modular technology lab with the goal of meeting their Strategic Plan.

After five years of operation, the modular technology lab has reached a point where evaluation needs to occur. The goal of this thesis is to evaluate six modules in the Mosinee Middle School modular technology lab to determine if they meet the following criteria: alignment of the Wisconsin Model Academic Standards in Technology Education for grade eight, are student-centered according to the Mosinee School District Strategic Plan, and, determine student-centeredness based on student's attitudes of the modules they experienced.

Since the School District of Mosinee uses as its framework in all important decisions their Strategic Plan, the wisdom of strategic planning needs to be looked at.

This thesis will determine the effectiveness of the modular technology lab by talking about the theory behind standards-based education. Student-centered learning is discussed to help the reader understand why Mosinee School District used this as a benchmark for educational excellence.

Since the School District of Mosinee purchased a modular technology education program, it is essential that looking at modular systems from their history to the education fields attitude of modules be explored.

Two mechanisms were developed to evaluate the modules. They represent mechanisms, which will give a simple percentage from the evaluation. The first mechanism is a matrix that measured the competencies of lesson within each module to the Wisconsin academic standards for technology education in grade eight. The author of the research paper designed this matrix. It was a simple crosscheck matrix to provide a visual comparison to alignment of curriculum for the modules to the state academic standards.

The second mechanism was a survey that was distributed to eighth grade students during the beginning of the 2001/2002 school year. These students experienced the modular technology lab while seventh graders the previous school year. This survey solicited the feelings of these students of how they felt about the module being evaluated. From this data, the evaluator determined whether the modules for evaluation met the criteria set forth in the introduction portion of the research. It was assumed that more than one of the modules for evaluation will be found not to measure up to Wisconsin academic standards for grade eight and match the district's strategic plan of being a student-centered learning lab.

The data gathered would be from the interpretation of the Wisconsin Model Academic Standards for grade eight by the author. In addition, the student-centeredness of the modules to be studied again will be in interpretation of the questioner data by the author.

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CHAPTER ONE

Introduction

The objectives and philosophy of technology education are high on the list in discussions of school curriculum issues. What is the role of technology education in our schools and why is the study of technology important (Baldwin, 1999)? Is technology education just a spin-off of manual and industrial arts or is it it's own separate entity? What should the framework and philosophy be?

> Industrial arts are "those occupations by which changes are made in the forms of materials to increase their values for human usage. As a subject for educative purposes, industrial arts is a study of the changes made by man in the forms of materials to increase their values, and of the problems of life related to these changes" (Bonser & Mossman 1923, p. 5). It is an educational program that seeks as it's goal to develop expertise in materials, processes, and tool use (Schultz, 1999).

Technology education is considered education about technology and its impacts on human kind. Technological literacy is its goal. As stated in the Wisconsin Model Academic Standards: "the need for literacy about this human effort, that is, the development and use of technical means, is the role of technology education" (Wisconsin Department of Public Instruction, 1998).

In their article on the framework for technology education in The Technology Teacher, Savage and Sterry (1990, p.7) defined goals of technology education as " Students, as part of total education, will become technologically literate and capable by acquiring knowledge and experience in: "Technological method, problems and opportunities, technological processes, resources, technological knowledge, evaluation, and management. "

Our society is becoming more dependent on technology in day-to-day life. Something as simple as the remote control on your television set, for example, when lost, has a negative effect upon the viewer of the television. The definition and philosophy of technology education is to help develop in students a literacy of technology. The goals of industrial technology education are:

1. To apply that literacy through materials processes and delivery methods allowing students to acquire both knowledge and experience technologically are wide, varied,

2. Offer both problems and opportunities (Rogers, 1998).

A method that is trying to meet both goals and is emerging as a delivery platform is the modular system of instruction. Modular technology education is defined as a "system that allows the teaching area, workroom, or laboratory to be divided into different learning workstations operating individually, but functioning as a part of the complete technology program" (Hearlihy & Co., 1994). Literature from LJ Technical Systems stated, "In the exploratory phase of the middle school program, students working in pairs will explore a wide range of different technologies, with little interaction with the teacher" (LJ Technical Systems Co. Inc., 2000, Section 1). Modular companies boast cross-curricular competencies built within their curriculum. An example from the Aerodynamics Module of LJ Technical Systems program claims life applications, as well as academic principles such as:

> Real World Application of the Technological or Scientific Principles – Examines the impact of aerodynamics in transportation technology.

Physical Science – Investigation of aerodynamic forces on objects and states the scientific principles which affect the aerodynamics of a body.

Mathematics – Uses and applies mathematics when investigating aerodynamic principles and applications.

Reading – Reads text, instructions, data from tables, diagrams and graphs when analyzing aerodynamic models.

Writing – Writes acceptable descriptions of observations and results found when investigating aerodynamics.

Problem Solving – Creates or improves a product, service or system to meet a given need. (LJ Technical Systems Co. Inc., Section 1, 2000)

Many schools have adapted the modular approach to the study of technology. Modular technology labs, according to Loveland in The Technology Teacher (1999, p. 10), "Save schools money by purchasing only one set of curricular materials." He continued: "Students working in a modular learning system are introduced to four types of learning: active, cooperative, individualized and interdisciplinary" (p. 10).

However, the modular approach is controversial. Many instructors feel they should be used as a supplement rather than as a complete program (deGraw & Smallwood, 1997). Are modular technology systems effective in helping students meet the goals, philosophy, and standards of Technology Education?

Some feel they are. "Whether modules are developed by vendors or teachers, the modular approach allows far more exposure to tools, materials, and processes than previous designs" (Gloeckner 1996, p. 27). Gloeckner added that modular systems that provided problem-solving activities within its curriculum were more successful than those that did not.

A similar viewpoint stated that modular labs allow for a wider scope in the study of technology. Jensen also felt that "…if one views our system of technology as content, it is the methodology of modular instruction that helps to model the aspects of management that we need to include in our instruction of technology as content" (Jensen 1999, p. 28).

However, not all view the effectiveness of modular instruction as skill-transferring and student-centered learning. Lacking is the opportunity for providing students with transferable problem-solving tools in a large-world setting (Hutchinson, 1996). She stated: "Students need more time than can usually be given in a modular experience to reflect upon how it applies to a number of different contexts (that is, transferability)" (p. 28).

As for being student-centered, two points are raised. First is the thought that modules are "module centered." Petrina (1996, p. 28) felt that the modules control what and how the student learns and generally not allowing for student's input or creative thinking or problem solving skill. Secondly, contention arises as to the means of delivery systems versus the ends. If the end is creating technologically literate, sensible, and politically astute citizens, modules have no relevance. They bring about a narrow impression in students and administrators of someone's idea of the future

In his master's thesis, Rud (1999) stated that most respondents to his survey determined that modular classrooms were weak in the areas of in-depth study and they had no practical application in the workplace. He also concluded from his research "that modular classrooms would be a complement to a schools technology program but should not be the sole source of teaching in the technology department" (p. 36).

The School District of Mosinee determined that a technology education program was needed at the seventh-grade level. Therefore, in 1996, a task force was formed to explore, evaluate, and recommend to the school board a commercial modular technology program. After six months of touring labs around the state of Wisconsin, it was determined that two vendors stood out: Synergistics and LJ Technical Systems. The criteria used had to fall within the Strategic Plan of the district which had been created and implemented one year prior (School District of Mosinee Strategic Plan, 1994). The lab selected had to: be student-centered, have a solid measurable objectives, provide activities that are authentic and relevant in a real-world setting, and meet the new Wisconsin Academic Standards.

Based on the above criteria, LJ Technical Systems was chosen as the vendor. In addition, this vendor was the only vendor at that time with a computerized management system which in addition to being the lab's server, it tracked students grades, progress, developed a variety of accountability reports, and even helped with scheduling module rotation.

Statement of Problem

Are selected modules in the modular technology education program in the Mosinee School District an effective method of delivering instruction in the study of technology that meet the goals, objectives, philosophy, and Standards of Technology Education, and the school district's Strategic Plan?

Purpose of Study

The purpose of this study was to analyze whether the middle school modular technology education program in the School District of Mosinee satisfied Wisconsin Technology Education academic standards and the district's Strategic Plan.

Research Question

The research questions for this study were:

1) Were the modules selected for analysis student-centered based on the district's definition from the Strategic Plan?
2) Did the modules meet Wisconsin's Academic Standards for Technology Education in grade eight?
3) Did the competencies stated for the problem-solving activities from the modules meet the criteria of Wisconsin Academic Standards for Technology Education for eighth grade and the district's strategic plan?
4) What were the student's attitudes of the selected modules?

Significance of the Study

This study was important to the field of technology education and to the School District of Mosinee for the following four reasons:

1. Future decisions in terms of grant requests, options of curricular change in the lower middle school grade(s), purchase of further modular technology in elementary grades, and referenda strategies may be enhanced by this study.
2. Future planning in curriculum development, transitioning students from the middle to the high school technology education programs, and cross-curricular opportunities will find value in this study.

3. Results of the study could apply to other modules used in the Middle School modular Technology Education Program.

4. The area of Technology Education and the decisions other districts may consider will have the advantage of using this study in the decision-making process.

Limitations to this study

While this study could be helpful to many school districts in Wisconsin, there are limits that will make this a study of a specific nature directly to the School District of Mosinee.

1) This study was restricted to the School District of Mosinee, Wisconsin, Middle School technology program.
2) The grade levels studied were seventh-grade required Technology Education.
3) Students in seventh grade meet every other day for the entire school year.
4) Average class size in the seventh grade was 16 students; mixed gender.
5) Students surveyed were from the 2000-2001 school year only.
6) Only the following modules will be studied: Weather Monitoring, Mechanisms, Biomedical Technology, CNC Technology, Video Production, and Aerodynamics.

Definition of Terms

Because of the unique nature of this study, content-specific terms are used to identify segments of the study.

Middle School – a building and student body within the School District of Mosinee comprising of grade levels four through eight in two sections: four and five, and sixth through eight.

Module – students, working in pairs exploring a range of technologies with little interaction with the teacher. (LJ Technical Systems Co. Inc., 2000).

Modular classrooms – a teaching area, workroom, or laboratory divided into different learning workstations operating individually but functioning as a part of the complete technology program. (Hearlihy & Co., 1994).

Technology Education – education about technology and its effect on human kind.

CHAPTER TWO

Review of Literature

This review of literature describes several essential aspects of technology education in a middle school setting. First, a discussion of the significance of strategic planning occurs. Given that the School District of Mosinee has based all curriculum development and capital expenditures on their strategic plan, it is essential as part of this research to understand how this plan led to the purchase of a modular technology laboratory.

Second, a discussion of standards-based education's role in technology education is essential to this study. The Wisconsin Model Academic Standards for Technology Education have been used as the benchmark for measuring the effectiveness of quality content to students in this study. This section describes the standards for technology education for grade eight in terms of problem solving and activities.

At the core of Mosinee School District's Strategic Plan is the concept of Student-centered learning. It is necessary to develop a foundation as to the general idea of the concept. The processes involved in creating a student-centered learning environment are discussed including how the Mosinee School District defines this process in general and at the middle level.

Since the primary focus of this research is to evaluate the effectiveness of a modular technology education program, this review of literature would not be complete without talking about modular technology programs and some of the debate occurring in this arena. Beginning with a look at the unit method to why the Mosinee School District chose a modular system envelops this research.

Strategic Planning

Public school districts today face many obstacles. High-stakes testing, revenue caps, demands from communities to become an extension of the family all put pressure on administrators and teaching staff alike. In order to achieve success in all of these areas as well as continue to improve in the future requires a plan (Cook, 1996). However, there is planning and then there is strategic planning. As superintendent William Shirer reported to the citizens of Mosinee, Wisconsin in his letter of introduction to the school district's Strategic Plan: "The purpose of strategic planning is to create the best possible future for the students of the school district" (Mosinee Strategic Plan, 2001)

The difference in the types of plans has more to do with one's vision of the future. William J. Cook differentiates planners into two categories: true futurists and pop futurists. The pop futurist urges "preparing" **for** the future while the true futurist prepares **of** the future. A strategic planner believes the future is yet to be made and you plan on how it is to made. (1996)

Cook goes on to state that strategic planning has hit professional educators as a response to the concerns of what many feel should be the nature and purpose of public education in America. With the constant amount of change in our country as well as globally, planning to create that change will prevent "the trauma of change." The changes that are affecting American public school systems are:

1. Demographics: between the mobility of our citizens to the aging of them, demographic change is inevitable.

2. Family restructuring: no longer does the majority of a family consist of mother, father, and two children.
3. Emerging minorities: diverse cultures now make up the majority in most large American city schools.
4. Redefining public education: constant debate and legislation as to what education should about.
5. Economic transitions: from agrarian to information including the wealth and demands that go with it. (1996)

The School District of Mosinee is not immune to these changes. Instead of reacting to these changes, Mosinee has opted to create their future through strategic planning. For Mosinee, strategic planning was a two step process. As Shirer states: "In 1994, the Mosinee Board of Education approved the district's first Strategic Plan. For five years, the first plan provided a focus for the board, administration, and staff, leading to significant improvements. Community use of school buildings, technology upgrades, changes in the fine arts, changes in our technical education program, the advent of a home building class, changes in the professional development for staff and other improvements were all outcomes of the original plan." (2001)

In December of 1999, a revision of the plan took place to meet the five-year deadline of the original plan. Action teams were created in the areas of Climate and Decision-making, Curriculum/Student-Centered Learning, and Ethics and Teamwork. Once the board of education approved their direction, the team met to identify ways to provide the money, time and personnel necessary to implement the Action Plans. In relation to curriculum, two important points stand out. First, all learning strategies planned from years one to five have at their base in designing curriculum that is student-centered. Training staff on how to develop this curriculum in year one, to assessing all curriculum for student-centeredness in year five. The second point in developing curriculum is the foundation that all curriculum developed will include core elements which are aligned with national and state academic standards. (2001)

The Mosinee School District Mission Statement is the cornerstone of the Strategic Plan. It states: "The mission of the Mosinee School District is to educate our students to be productive and contributing members of a global community, able to succeed in our changing world, by providing a safe, challenging, student-centered environment" (1994).

This statement provided the framework and vision to draft the rest of the plan. The objectives of the included: Ethical Behavior, Communication, Problem Solving, Technology, and Working Effectively with Others.

All Mosinee School District curriculum development, capital expenditures, and district values are based on this plan and was therefore the benchmark used in determining the technology education program in the Middle School (2001).

Standards-based Education

Whether one agrees with the standards or not, they are here and curriculum must be aligned with them. Schools that have successfully and objectively implemented academic standards are seeing very good results in terms of student achievement. Those schools that have been successful with academic standards implementation have several common threads: high expectations and standards-focused instruction, comprehensive testing systems to monitor student achievement, extra instruction and attention devoted to low-performing students, professional development focused on teaching the academic standards, and parent involvement that emphasizes standards and achievement (Bosser, 2001).

However, as the standards issue and academic accountability pick up steam, states need to review their assessment mechanisms to broaden opportunities for students to show what they know, can perform, and have learned. Currently, 49 states are including multiple choice questions in their testing mechanisms. Thirty-eight states are including short answers, and 46 include essay instruments or offer performance-based tasks in subjects other than English. Two states are using portfolios (Editors, 2001).

Standards can and should be used as a positive methodology for providing authentic assessment as well. Reeves stated: "The focus of academic standards should be on rigorous classroom assessment, and the influence of that assessment process is overwhelmingly positive for the thinking, reasoning, and communications skills of students and their performance on high-stakes tests" (2001, p. 5).

Reeves felt that numerous standards are flawed. He stated that many state standards lack "descriptive rigor" and that most standards exceed the capacity of typical time available in a school year. While these arguments present a good rationale to improve standards, they are not arguments for the rejection of standards. Interestingly, Reeves (2001) stated: "the rejection of standards represents the embrace of the bell curve" (p. 6).

Mastery of academic standards should become the focus of classroom assessment. Four significant features occur. First, a comparison to student's performance and a standard rather than to a norm, average, or to other students in other parts of the world give a more authentic picture of student progress. Second, rather than testing student's cognitive acquisition, students demonstrate their mastery of a standard. Third, standards-based assessment is not "veiled" in secrecy. Student's expectations are clear up-front to teachers, parents, students, and school officials. Fourth, and most important, the focus of standards based assessments is to improve student's learning, not to gain a "number." Hence, standards-based assessments require students to write, explain, demonstrate, create, and analyze – in brief: to think.

Technology education standards have been developed in Wisconsin. At their forefront is the duty to create in students literacy "about human effort, that is, the development and use of technical systems to solve problems either individually or in a team setting" (Wisconsin Department of Instruction 1998, p. 1).

While Wisconsin has yet to develop a "testing" mechanism for the standards in technology education, these standards offer teachers opportunities to create relevant and exciting curriculum that is student-centered. As the list of model standards below points out, these standards are open-ended enough where students can not only creatively think in achieving the standards, but teachers individual teaching styles can be exercised.

The Wisconsin model academic standards in technology education are framed with the idea in mind that learning about and with technology a step further than other content areas. It in and of itself becomes a school subject with the goal being technology literacy for every one. A technology education curriculum would then involve students in: designing, developing, and utilizing technological systems, open-ended, problem-based design activities, applying technological knowledge and processes to real world experiences using up-to-date resources, and working individually as well as in a team to solve problems (Wisconsin Department of Instruction 1998, p. 1).

The Wisconsin model academic standards in technology education attempt to provide a framework for students to achieve this goal by breaking down the standards into four major categories. Within each category, subgroups by grades four, eight, and twelve have individual benchmarks of achievement for Wisconsin students. For grade eight they consist of:

A. The nature of technology.

A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enables us to develop better technology.

A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in technological activities.

A.8.3 Identify and contrast the connections and differences between technology and other disciplines.

A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an equal basis.

A.8.5 Analyze how cultures and groups value technology differently and how these values influence the development and acceptance of technology.

A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur because of social and political systems.

A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an opportunity or solve a problem.

B. Technological systems

B.8.1 Compare and contrast the function of each of the following common elements of technological systems: inputs, processes, outputs, and feedback.

B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired outcome.

B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large number of complex components, or use in applications beyond its original purpose.

B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and outputs from one system may be inputs to another system.

B.8.5 Evaluate large and complex systems to determine the ways in which they are creations of human ingenuity.

B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability, appropriate application, and regard for the environment.

B.8.7 Compare and contrast the use of tools, processes, and materials in diverse applications; such as, auto production, health care, food processing, laboratory research, and space exploration.

C. Human ingenuity

C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints.

C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing.

C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials, resources, and waste in technological systems.

C.8.4. Predict possible outcomes of a newly designed technological system.

C.8.5 Explain the value of technical knowledge and teamwork in the development of a device or process.

C.8.6 Explain how changing the physical characteristics of material or the format of information can increase its usefulness.

D. The impacts of technology.

D.8.1 Explain the difficulty in predicting the effects a new technology will have on society and the environment due to a lack of experience with the technology.

D.8.2 Explain the importance of making projections, studying scenarios, and making thoughtful decisions because of the direct and indirect effects technology will have on the future.

D.8.3 Contrast the advantages and disadvantages of given technology and make adjustments or develop new technologies if disadvantages outweigh the advantages.

D.8.4 Explain why people must think about how a new technology might affect other people, societies, and the ecosystem in which we live.

D.8.5 Explain that people can control the technologies they develop and use and that people are responsible for the environment.

These standards have helped focus the purpose and philosophy of technology education for the state of Wisconsin and in turn, have helped to guide those who teach the discipline in helping students understand the goal of technology education.

Student-Centered Learning

Creativity, flexibility, and lifelong learning are requirements needed to be successful in a real world. According to David Thornburg, in order for students to acquire these skills, schools need to be organized around the learner not the teacher (1995).

Education reform has as one its threads the concept of student-centeredness. Student-centered learning takes the idea of what is to be learned from what the teacher *desires* to teach and directs instruction to what students *need* to learn. (Martin, 1997) An accepted model in this process included:

1. Students discover knowledge rather than teachers simply transferring information to students.
2. Continuous student and course assessment, not just student achievement, are used as tools to analyze teaching.
3. Learning includes student-driven episodes, not just lectures or reading.
4. Others observe student performance versus only private assessment by instructor.
5. Students help define the questions rather than instructors simply handing out facts.
6. Student takes an active and proactive role in learning versus being a passive audience member.
7. Student learns collaboratively versus being rewarded for individual, competitive performance.
8. Educational productivity is judged in terms of student learning not just teacher workload.
9. The teacher helps student discover and structure the problems and questions, then coaches student in how to seek answers. In short, create problem-solvers.

10. Support staff focus their efforts on the creation of all teacher-defined learning environments – beyond just the classroom (Alley, 1996).

Providing real-world learning challenges and experiences using technology helps form a quality educational program. Several reasons are behind this thought. First, students, upon leaving their K-12 experience, will encounter a world that is not only information hungry, but will require people who can create, manage, distribute, and store information. This requires people who possess skills in technology literacy as well as problem solvers to develop ways of managing this information. In order for students to develop these skills, proactive learning environments are paramount. Exposing students to experiences that will develop a sound literacy of technology will enable them to construct meaning of their learning and develop knowledge from their personal vantage point. In other words knowledge that has meaning and functionality to the student. For example, in a paradigm of teaching, traditional methods hold that knowledge is transferred from teacher to student by lecture, worksheets, or reading. Student-centeredness shows that knowledge is jointly constructed by both student and teacher with the teacher being more the facilitator and mentor (Cook, 1998).

Classrooms are now being looked upon as “a center of intellectual inquiry.” Allowing students to form ideas, take risks, make mistakes, critically think, fix mistakes, and learn how to problem-solve from those mistakes. Interaction is no longer between teacher to student; it now needs to be multidirectional. Students; in the process of learning, will interact with teachers, peers, parents, and even professionals outside of the school building in order to seek and understand their learning (Martin, 1997).

Most traditional learning methods require students to commit fact to rote memory. Rote memorization at best; on Blooms Taxonomy, targets the lowest cognitive level – that of knowledge. However, true learning takes place at the analysis to the evaluation levels. For passing tests, rote helps students recall specific facts, terminology, criteria, methods, principles, generalizations or theories. Within true student-centered environment, students are presented with problems and solving methods that create skills to the top three rungs of the taxonomy. Analysis, synthesis, and evaluation require the learner to (in order of domain): break down information into separate parts, explicitly define the relationship between parts and organizational structure in order to better understand the complex whole. From analysis, learner then synthesizes information by combining two or more parts into a form new to the learner such as new communication, plan, or abstract relationship. At this point, learner then judges information or knowledge against some appropriate criteria (evaluation) (Cook, 1998).

The School District of Mosinee in its Strategic Plan determined that having a student-centered learning environment at every grade level will help the students in the district become life-long learners. In order to achieve this, they set out to define student-centered learning in the following fashion:

We… school personnel, students, parents, government, and community, *will revise…*will adjust, modify, and improve, *curriculum…*measurable objectives that students are required and want to meet-this includes a certain knowledge base that all students must learn using heir learning styles, what students learn must have real-world applications where possible *and focus…*clarify and concentrate *on student-centered learning..* multiple learning environments and expectations for students based on their specific learning styles, abilities, developmental capabilities, skills, interest, and goals (School District of Mosinee Strategic Plan, 2001).

At the middle school level in the Mosinee School District, a more specific definition was developed: "Student-centered learning is a process where students learn through a hands-on approach. Student centered instruction is differentiated to accommodate for student's individual learning styles, abilities, interests, and encourages student choice and responsibility" (Mosinee Middle School Building Leadership Team, 2001).

Most educational reformist agree, student-centered learning develops in students critical thinking and problem-solving skills by creating an environment to allow students to take risks, make and learn from mistakes, and assess using authentic, real-world situations (Martin, 1997).

Modular Systems

Where modular systems fit in the discussion of technology education's role pedagogically is controversial. Many experts disagree as to the effectiveness of the modular concept as method of delivering true technology education curriculum.

This debate started in the late Fifties and early Sixties when a method of instruction was introduced in science classes called the *Unit Method*. It was a way to develop a student centered learning environment through guided experience. The unit of study would have clear objectives that were documented (Billet, 1960).

The Unit Method resembles today's modular systems in several ways. Unit assignment activities had four purposes in which they served. The *Introductory* step identified prior knowledge and interests of the student (Pretest). The *Laboratory* step provided students activities aimed at their initiative (Assignment activities.) The *Evaluative* step was designed to determine the growth of the whole student. Tests at times could be incorporated as an instrument for such means (Post test). The *Pooling and Sharing* Step has as its main emphasis students learning as much as possible from each others accomplishments. This was accomplished through writing, oral presentations, exhibits, demonstrations, and other ways of presenting achievements to students whom had not participated in the activities (Enrichment) (Billet, 1960).

In his article on Research and Experimentation in the Junior High School, Donald Maley discussed the concept of the scientific method being mirrored in Industrial Arts classes. He states: "Most industrial arts educators will agree that modern industry is a product of science and technology." (Maley, 1960) He continues: "We need to be builders of men rather than inspectors of projects. Student activities should be centered around the testing, analysis, and investigation of tools, materials, and processes. The traditional program was almost completely dominated by the "making or building" with the end being an item that could be taken home. The making is now carried on towards the end of developing experimental apparatus and the pursuit of product, tool, material, or process analysis, testing, or development (Maley, 1960).

Over time, vendor produced modular systems; following the method stated above, began to find their way into schools. Modular Technology Education is defined as a "system that allows the teaching area, workroom, or laboratory to be divided into different learning workstations operating individually, but functioning as a part of the complete technology program (Hearlihy 1994). Literature from LJ Technical Systems states "In the exploratory phase of the Middle School Program, students working in pairs will explore a wide range of different technologies, with little interaction with the teacher (LJ Technical Systems Co. Inc., 2000, Section 1).

The term "modular" is an adjective describing standardized units for easy construction or flexible arrangement. (Kandau, 2001) In an effort to provide curriculum that targets all learning styles, flexibility is paramount. Modules offer a format that brings theory into practice.

In her article on the advantages of using modules as a delivery method, Candy Kadau (2001) listed several reasons a modular approach is effective:

1) They provide concentrated learning with immediate application. Each module concentrates on the technology it represents. They provide the ability to "integrate and immediately and effectively apply."
2) They provide learning reinforcement. The activities build on previous student knowledge and provide a steady improvement of that knowledge over time.
3) Organizational control is part of the modular experience. Because of the content flexibility, the instructor maintains greater control over what is being taught. Modules can be altered to fit current student needs.
4) Programs are easily modified. Traditional programs are rigid and inflexible, but the modular approach can be tailored to a schools specific need.
5) They cover a wide variety of technologies. Rather than having an instructor teach about many different technologies and attempting to provide activities that cover those technologies, modules fill that bill more effectively and thoroughly.

However, not all technology educators are as quick to embrace the modular concept. Many feel that modules allow for exploration but depth is sacrificed. A competency in using tools, machines, and instruments is lacking. Selection of laboratory equipment should be based on the program's philosophy and goals. If a school district's philosophy includes providing skills in industrial technology for example, those needs have to be considered when developing a program.

George Rogers, while doing industrial teacher training research discovered that many industrial teacher educators have not been equipping graduates for the industry-related classrooms the new teachers will be entering. Rogers stated: "Industrial teacher educators must not yield to the non-skill oriented technology education modules in place of skill development in industrial processes." (1998) Rogers advocated teacher educators need to provide students with the combination of skills to be able to teach in both the industrial processes and modular environments and teach them to blend these processes into the newer methods.

What lies in the future? Dave Pullias felt that modules are a stop-gap measure. With the limited experiences they provide, and the lack of skills taught, many teachers are pondering what students should do after they have experienced the modular lab for a semester or a year? In addition, where do students get true problem-solving experiences? At questions is what next step is there for a student to see how their modular experience fits together in the big picture (1997, p. 28).

Pullias states that "student experiences provided with the modular labs are what can be considered lower level. All students do is follow directions. They really don't have an opportunity to develop and use creative problem-solving skills, or to demonstrate a true understanding of the various concepts being addressed" (1997).

Technology education is one place in education where students have the opportunity to tie all other content areas into real-world experiences and watch how they interact to solve real, everyday problems.

The next level is to train students to be true problem-solvers and critical thinkers. It is learning about technology, understanding it, and then demonstrating understanding of technology by using it to solve real-world problems. Student assessment is beyond student recall and goes into a performance-based environment where students have designed, produced, and explained their solution to a problem (Pullias, 1997).

Many of the people cited in this paper seem to agree in principle on **some** aspects of the positive use of modular instruction in technology education. They feel it will lessen efforts of technology teachers in designing technology-based programs and help in handling mundane classroom management responsibilities (Daugherty, 1996). However, many felt what is lacking is the next step: to present students with real-world problems and the knowledge and skills to develop and explain solutions (Hutchinson, 1996).

CHAPTER THREE

Methodology

This chapter describes the evaluation procedures and why themodules were chosen. In addition, the two instruments used to evaluate the selected modules will be discussed in terms of their validity, content, reliability, and relationship to the benchmarks used: the Wisconsin academic standards for technology education grade eight and the Mosinee School District strategic plan.

This chapter discusses the limitations of the methods of research.

Selection of Sample

The modular technology lab in the Mosinee Middle School consists of sixteen modules. They are: Weather Monitoring, Mechanisms, Construction Technology, Research and Design, Health Management, Biomedical Technology, CNC Technology, Robotics, Graphics and Animation, Multimedia Production, Alternative Energy, Communications Technology, Aerodynamics, Space Technology, Desk Top Publications, and Video Production. Of these modules, only Weather Monitoring, Mechanisms, Biomedical Technology, CNC Technology, Video Production, and Aerodynamics will be evaluated due to their popularity with students. These six modules have several things in common. First, each of them are all hands-on. That is, students must manipulate equipment in order to complete experiments or simulations. Biomedical technology, CNC Technology, video production and aerodynamics each contain activities where students create products and give them something to take home.

Secondly, each of the modules present problem solving activities that simulate the design brief used in engineering practices for the principles of design. In the case of video production, it requires creation of storyboards and scripts.

Instrumentation

There were two mechanisms developed to evaluate the modules. They each provide a simple percentage from the evaluation. The first mechanism is a matrix that measures each lesson within each module to the Wisconsin Academic Standards for Technology Education in grade eight. A second matrix was developed that evaluated whether selected modules meet the criteria of student centered learning by definition of the district's strategic plan. It is a simple crosscheck matrix to provide a visual comparison to alignment of curriculum for the modules to the state academic standards and the Mosinee strategic plan.

The second mechanism was a survey that was distributed to eighth grade students during the beginning of the 2001/2002 school year. This survey solicited the feelings of these students of how they felt about the module being evaluated. The survey was given to those students whose parents return a slip granting permission for students to participate in the survey. An example of each mechanism follows the methodology discussion.

Data Collection

For the comparison matrix, percentages were gathered from the alignment data for the Wisconsin academic standards portion.

From the survey, simple statistical percentages will be gleaned from student's responses. These percentages will then be used to determine relevance from the student's standpoint for recommendation to phase-out or upgrade.

Data Analysis

The data was used to determine whether the modules for evaluation meet the criteria set forth in the introduction portion of the research.
The data was from the interpretation of the Wisconsin Model Academic Standards for grade 8. In addition, the student-centeredness of the modules were determined.

Limitations

The limitations of the methodology are:

1. The evaluation of the modules using the matrix are subject to the evaluators interpretation of the Wisconsin model academic standards in technology education for grade eight as well as the evaluator's interpretation of the module's objectives.
2. The student survey is limited by the number of parents granting permission to for their child to participate in the survey.
3. Students surveyed may have bias toward instructor and/or the module(s) being evaluated.
4. Not all students agree to participate in the survey.
5. The students surveyed are from only one school year: 2000-2001 school year. The modules have been a part of the seventh-grade curriculum since the 1997-1998 school year.

CHAPTER IV

Results and Discussion

In order to accurately answer the research questions on the modules studied: Weather Monitoring, Mechanisms, Biomedical Technology, CNC Technology, Video Production, and Aerodynamics, two types of measurement instruments were developed. The first instrument was a matrix of Wisconsin's Model Academic Standards for Technology Education for eighth grade. The matrix contained each standard in the X-axis column and the coordinating lessons in the Y axis column. The basis for this layout allowed the evaluator to check off which lesson competencies meet specific standards. The matrices for each are included in this chapter.

The second instrument developed was a questionnaire, which was distributed to current grade eight students in the Mosinee Middle School. The purpose of this questionnaire was to gather student attitudes toward the modules for the purpose of establishing student-centered learning from a student's perspective.

Student Survey Results

The parental permission form and survey was created and mailed to 131 parents of eighth grade students in the Mosinee School District. Of the number of surveys mailed, 21 were returned completed. This represented 16% of the total number of surveys mailed.

The tables on the next page represent the percentages of response for the questions asked of the eighth grade students. Question number one in the survey was not used for data analysis. This question was used to help respondents remember what modules they had worked on for the school year of 2000/2001. The tables following questions two through five contain percentages that represent the total responses. For questions six through eleven, the percentage value represents the percentage of total respondents.

2**. Did you complete any of these modules through the post-test?**

YES	**62%**
NO	**33%**
TOTAL RESPONDED	**95%**
NOT ANSWERED	**5%**

3. Did you complete the Writing and Research module?

YES	**29%**
NO	**52%**
TOTAL RESPONDED	**81%**
NOT ANSWERED	**19%**

4. Did you complete any of the problem-solving activities in your four modules?

YES	**57%**
NO	**38%**
TOTAL RESPONDED	**95%**
NOT ANSWERED	**5%**

5. Of the four modules you experienced, which one was your favorite?

This table shows how many of the respondents chose the listed modules as their favorite of the four they rotated through for the school year. The percentages are based on the number of respondents who took these modules.

AERODYNAMICS	**0%**	**ROBOTICS AND AUTOMATION**	**0%**
ELECTRONIC COMM	**4%**	**RESEARCH AND DESIGN**	**4%**
ALTERNATIVE ENERGY	**4%**	**CONSTRUCTION TECHNOLOGY**	**10%**
MULTIMEDIA COMMUNICATION	**0%**	**MECHANISMS**	**4%**
GRAPHICS AND ANIMATION	**4%**	**WEATHER MONITORING**	**4%**
VIDEO PRODUCTION	**33%**	**SPACE TECHNOLOGY**	**0%**
COMPUTER AIDED PUBLISHING	**0%**	**HEALTH MANAGEMENT**	**0%**
CNC TECHNOLOGY	**19%**	**BIOMEDICAL TECHNOLOGY**	**0%**

The remaining questions will ask your opinion of your experience of your favorite module.

The questions listed below contain the total percentages of responses and the total number of respondents who did not respond to the specific question.

6. **How would you rank your feelings about this module?** (5 is very interested, 0 is not at all interested.) 91% of respondents answered this question. 10% did not.

7. **How would you rank the amount of hands-on activities with this module? (5 indicate a satisfactory amount, 0 not enough.)** 91% of respondents answered this question. 9% did not.

8. **How would you rank the hands-on activities? (5 means they were very interesting and fun, 0 means they were not interesting)** 91% of respondents answered this question. 9% did not.

9. **How would you rank how well the activities helped you to better understand the technology you were studying? (5 are a good understanding, 0 means you didn't get it.)**

95% of respondents answered this question. 5% did not. Of the students that responded, 67% felt the activities helped them to better understand the technology they were studying. The other 28% of respondents were not sure whether or not the module stated helped them to understand the technology.

10. How would you rank the difficulty of the reading? (5 is very difficult, 0 means you had no problems with the reading)

86% of respondents answered this question. 14% did not. Of those that responded, 24% felt the reading level to be difficult. 62% of the respondents felt the reading level was appropriate for their comprehension level.

11. How would you rank the use of the Learning Log? (5 means it helped you to reflect on what you did each day, 0 you found it to be of no benefit to you.)

93% of respondents answered this question. 7% did not. Of the respondents, 20% felt the Learning Log helped them to reflect upon their learning each day. 73% of respondents felt the Learning Log only moderately or didn't help them reflect upon their learning.

QUESTION #	5	4	3	2	1	0
6	**33%**	**48%**	**10%**	**0%**	**0%**	**0%**
7	**43%**	**48%**	**0%**	**0%**	**0%**	**0%**
8	**43%**	**24%**	**19%**	**5%**	**0%**	**0%**
9	**29%**	**38%**	**14%**	**14%**	**0%**	**0%**
10	**5%**	**19%**	**19%**	**10%**	**14%**	**19%**
11	**10%**	**10%**	**29%**	**10%**	**10%**	**24%**

Module Standards Alignment

The second mechanism to measure the research questions are matrices which measure the module alignment to the Wisconsin Model Academic Standards. These matrices follow this page. The cells that are filled in with the bold X indicate this lesson is aligned with the particular standard in the cell. Of note for the standards alignment, to the degree the specific lesson competencies from the modules evaluated are aligned to a particular standard was up to the interpretation of the researcher.

WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enables us to develop better technology.	X	X	X	X		X	X	X	X	X
A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in technological activities.	X	X	X	X	X	X	X	X	X	X
A.8.3 Identify and contrast the connections and differences between technology and other disciplines.	X	X	X	X	X	X	X	X	X	X
A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an equal basis.										
A.8.5 Analyze how cultures and groups value technology differently and how these values influence the development and acceptance of technology.										
A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur because of social and political systems.										
A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an opportunity or solve a problem.										
B.8.1 Compare and contrast the function of each of the following common elements of technological systems: inputs, processes, outputs, and feedback.										
B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired outcome.	X	X	X		X	X	X	X	X	X
B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large number of complex components, or use in applications										
B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and outputs from one system may be inputs to another.										
B.8.5 Evaluate large and complex systems to determine the ways in which they are creations of										
B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability,										
	X	X	X	X	X	X	X	X	X	X
C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints.										
C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing										

WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials, resources, and waste in technological systems.										

WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enables us to develop better technology	X	X					X	X		
A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in technological activities					X	X			X	X
A.8.3 Identify and contrast the connections and differences between technology and other disciplines.										
A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an equal basis										
A.8.5 Analyze how cultures and groups value technology differently and how these values influence the development and acceptance of technology										
A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur because of social and political systems										
A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an opportunity or solve a problem										
B.8.1 Compare and contrast the function of each of the following common elements of technological systems: inputs, processes, outputs, and feedback										
B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired outcome										
B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large number of complex components, or use in applications										
B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and outputs from one system may be inputs to another										
B.8.5 Evaluate large and complex systems to determine the ways in which they are creations of										
B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability,										
B.8.7 Compare and contrast the use of tools, processes, and materials in diverse applications; such as, auto production, health care, food processing	X	X	X	X	X	X	X	X	X	X
C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints.										
C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing										
WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials,										

WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enables	X	X	X	X	X	X	X	X	X	X
A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in	X	X								
A.8.3 Identify and contrast the connections and differences between technology and other disciplines.	X	X	X	X	X	X	X	X	X	X
A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an										
A.8.5 Analyze how cultures and groups value technology differently and how these values influence										
A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur										
A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an	X									
B.8.1 Compare and contrast the function of each of the following common elements of technological systems:	X	X		X	X	X	X	X	X	X
B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired	X	X						X	X	X
B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large										
B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and	X			X	X	X		X	X	X
B.8.5 Evaluate large and complex systems to										
B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability,	X			X	X	X				
B.8.7 Compare and contrast the use of tools, processes, and materials in diverse applications; such	X			X	X	X		X	X	X
C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints.								X	X	X
C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design,								X	X	X
WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials,										

WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enables										X
A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in										
A.8.3 Identify and contrast the connections and differences between technology and other disciplines.	X									
A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an										
A.8.5 Analyze how cultures and groups value technology differently and how these values influence										
A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur										
A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an										
B.8.1 Compare and contrast the function of each of the following common elements of technological systems:	X	X	X	X	X	X				
B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired				X		X		X	X	
B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large		X	X							
B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and				X		X				X
B.8.5 Evaluate large and complex systems to										
B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability,		X	X			X				
B.8.7 Compare and contrast the use of tools, processes, and materials in diverse applications; such				X						X
C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints.										
C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design,				X		X		X		X
WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials,										

WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enables us to develop better technology										
A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in technological activities										
A.8.3 Identify and contrast the connections and differences between technology and other disciplines.										
A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an equal basis										
A.8.5 Analyze how cultures and groups value technology differently and how these values influence the development and acceptance of technology										
A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur because of social and political systems										
A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an opportunity or solve a problem										
B.8.1 Compare and contrast the function of each of the following common elements of technological systems: inputs, processes, outputs, and feedback	X	X	X	X		X	X		X	X
B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired outcome	X	X	X	X		X	X		X	X
B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large number of complex components, or use in applications										
B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and outputs from one system may be inputs to another	X	X	X	X		X	X		X	X
B.8.5 Evaluate large and complex systems to determine the ways in which they are creations of										
B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability,										
B.8.7 Compare and contrast the use of tools, processes, and materials in diverse applications; such as, auto production, health care, food processing		X	X	X						
C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints.				X				X		
C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing				X						X

WISCONSIN MODEL ACADEMIC STANDARD	*LSN 1*	*LSN2*	*LSN3*	*LSN4*	*LSN5*	*LSN6*	*LSN7*	*LSN8*	*LSN9*	*LSN10*
C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials,										

WISCONSIN MODEL ACADEMIC STANDARD	***LSN 1***	***LSN2***	***LSN3***	***LSN4***	***LSN5***	***LSN6***	***LSN7***	***LSN8***	***LSN9***	***LSN10***
A.8.1 Show that technology has allowed us to further the efforts of science and, in turn, science has enables us to develop better technology.	X					X		X		X
A.8.2 Explain the need for and application of knowledge and skills from other disciplines when engaging in technological activities.	X	X								
A.8.3 Identify and contrast the connections and differences between technology and other disciplines.	X	X	X		X	X	X		X	X
A.8.4 Determine that technological knowledge is valuable but not always available to everyone on an equal basis.										
A.8.5 Analyze how cultures and groups value technology differently and how these values influence the development and acceptance of technology.										
A.8.6 Analyze the distribution and access of various technologies and explain how inequities occur because of social and political systems.										
A.8.7 Discover that human will or desire can lead to the design of new technology in order to seize an opportunity or solve a problem.										
B.8.1 Compare and contrast the function of each of the following common elements of technological systems: inputs, processes, outputs, and feedback.										
B.8.2 Analyze various systems and identify the ways in which they are controlled to produce a desired outcome.								X		X
B.8.3 Identify potential sources of failure in a system; such as, defective parts, maintenance needs, a large number of complex components, or use in applications										
B.8.4 Discover that resources are essential; they must be used effectively to produce a desired outcome, and outputs from one system may be inputs to another										
B.8.5 Evaluate large and complex systems to determine the ways in which they are creations of										
B.8.6 Identify all the resources necessary for a given system; analyze how the use of the resources will be affected by consideration for cost, availability,										
B.8.7 Compare and contrast the use of tools, processes, and materials in diverse applications; such as, auto production, health care, food processing				X	X					
C.8.1 Research and develop a set of solutions to solve a problem not knowing all constraints.										
C.8.2 Explain and demonstrate several solutions to a problem or opportunity using technological design, tools, careful planning, experimentation, and testing										
C.8.3 Brainstorm and illustrate ways to integrate efficiency into design through the reuse of materials,										

Narrative of Data Analysis

The data gathered for this study was intended to provide the researcher findings, which answers the four questions of the research problem. The research problem; which is repeated below asked:

Are selected modules in the modular technology education program in the Mosinee School District an effective method of delivering instruction in the study of technology that meet the goals, objectives, philosophy, and Standards of Technology Education, and the school district's Strategic Plan?

The research questions for this study were:

1). Were the modules selected for analysis student-centered based on the district's definition from the Strategic Plan?

From the Mosinee School District's definition of student-centered learning, as well as the Mosinee Middle School Building Leadership Team's definition, the data seems to indicate CNC Technology and Video Production Technology were very popular. These modules also lent themselves more to student-centeredness. The competencies for these two modules offer students two items that indicate student-centeredness (1) hands-on activities where students create a take-home item and in the process of completing these activities and (2) work to the student's individual learning styles.

2). Did the modules meet Wisconsin's Academic Standards for Technology Education in grade eight?

The data from the matrices on the standards alignment seems to indicate that several of the module competencies align with the standards substantially: Biomedical Technology, CNC Technology, Video Production Technology, and Mechanisms. Of the six modules, evaluated, only Weather Monitoring seems to skim the standards.

3). Did the competencies stated for the problem-solving activities from the modules meet the criteria of Wisconsin Academic Standards for Technology Education for eighth grade and the district's strategic plan?

Each vendor-designed problem solving activity comprises Assignment 10 for all the modules in this program. Based on the evaluation of standards-alignment, only CNC Technology and Aerodynamics are grounded in the standards.

4). What were the student's attitudes of the selected modules?

Based on the survey data, respondents seem to favor video production and CNC Technology.

Summary Statement

The data gathered measured two critical issues in terms of the effectiveness of the Mosinee Middle School modular technology education system. First, were the competencies of the ten lessons in the evaluated modules aligned with the Wisconsin Model Academic Standards for grade eight and are these six modules student-centered according to the Mosinee School District Strategic Plan and the Mosinee Middle School Building Leadership Team definition. The instruments used to gather the data seems to have measured the effectiveness of these modules and answered the two questions. The following chapter will state the findings in depth and offer a conclusion.

CHAPTER V

Summary

Technology Education has taken on many faces over the last twenty years. Making a transition from the Manual Arts to Industrial Arts took nearly fifty years. However, the transition to education about technology evolved in as little as ten years. Brought about by the launch of Sputnik, American educators felt a need for students in the middle and secondary grades to not only learn how to work with their hands, but to understand the entire scope of technology from its need to its impact on societies and the environment. In short: to help create students who are technologists.

The School District of Mosinee, in the spring of 1994, developed a document whose purpose was to drive both curriculum decisions as well as educational purchases. Based on Cook's philosophy of strategic planning, the district set about ensuring that their new middle school Technology Education program met the litmus test of their strategic plan. That is, that the program be standards-based and student centered. In 1997, Mosinee purchased a modular technology lab with the goal of meeting their Strategic Plan.

After five years of operation, the modular technology lab has reached a point where evaluation needs to occur. The goal of this thesis is to evaluate six modules in the Mosinee Middle School modular technology lab to determine if they meet the following criteria: alignment of the Wisconsin Model Academic Standards in Technology Education for grade eight, are student-centered according to the Mosinee School District Strategic Plan, and, determine student-centeredness based on student's attitudes of the modules they experienced.

Since the School District of Mosinee uses as its framework in all important decisions their Strategic Plan, the wisdom of strategic planning needs to be looked at.

This paper determines the effectiveness of the modular technology lab by talking about the theory behind standards-based education. Student-centered learning was discussed to help the reader understand why Mosinee School District used this as a benchmark for educational excellence.

Since the School District of Mosinee purchased a modular technology education program, it is essential that looking at modular systems from their history to the education fields attitude of modules be explored.

Two mechanisms were developed to evaluate the modules. They represent mechanisms, which will give a simple percentage from the evaluation. The first mechanism was a matrix that measured the competencies of lesson within each module to the Wisconsin academic standards for technology education in grade eight. It was a simple crosscheck matrix to provide a visual comparison to alignment of curriculum for the modules to the state academic standards.

The second mechanism was a survey that was distributed to eighth grade students during the beginning of the 2001/2002 school year. These students experienced the modular technology lab while seventh graders the previous school year. This survey solicited the feelings of these students of how they felt about the module being evaluated. From this data, the evaluator determined whether the modules for evaluation met the criteria set forth in the introduction portion of the research.

The data gathered would be from the interpretation of the Wisconsin Model Academic Standards for grade eight. Student-centeredness of modules studied was an interpretation of the questioner data.

Statement of the Problem

Are selected modules in the modular technology education program in the Mosinee School District an effective method of delivering instruction in the study of technology that meet the goals, objectives, philosophy, and Standards of Technology education, and the school district's Strategic Plan?

The research questions for this study were:

1. Were the modules selected for analysis student-centered based on the district's definition from the Strategic Plan?
2. Did the modules meet Wisconsin's Academic Standards for Technology Education in grade eight?
3. Did the competencies stated for the problem-solving activities from the modules meet the criteria of Wisconsin Academic Standards for Technology Education for eighth grade and the district's strategic plan?
4. What were the student's attitudes of the selected modules?

Conclusions

The four questions stated with the problem were answered in the survey data and in the analysis of the alignment of competencies in each lesson with the Wisconsin Model Academic Standards for grade eight. The testing instruments answered these questions. Question one asked whether the modules selected for analysis were student-centered based on a definition found in the district's strategic plan. Two modules stood out as student-centered based on response to the student survey: CNC Technology and Video Production Technology. These modules proved to be the two top favorites of respondents. The other four modules: Aerodynamics, Weather Monitoring, Biomedical Technology, and Mechanisms offer a "hands-on" approach to learning however, students seem to think; based on the survey results, that the activities do not necessarily fit their interest area.

Question two asks whether the competencies of the studied modules met the Wisconsin Model Academic Standards for grade eight. While each of the modules analyzed met some of the standards, two modules stood out as being more standards-based than the other four: CNC Technology and Aerodynamics. This conclusion was reached based on the description of the competencies found in the instructor's guide.

Question three sought to find how well the problem-solving activities contained in the modules meet the Wisconsin Model Academic Standards and student-centeredness according to the district's strategic plan. In terms of standards, Aerodynamics, and CNC Technology again lend themselves to meet standards. Assignment ten in each of the modules analyzed is the assignment where a design brief is posed to the student. The brief walks the student through the design process and the student creates a solution to the problem based on the design.

Question four analyzed student attitudes of the modules studied. The questionnaire was the instrument used to evaluate the results. Overall, students seem to like the modules however there were portions of each they found either not relevant or not interesting.

Recommendations Related to This Study

An additional purpose to this study is to present the findings to the school board of the School District of Mosinee. As stated earlier, this modular program is in its fifth full year of operation. In the five years of use, technologies have improved vastly. In addition, many of the pieces of equipment of this program have seen extensive use. Many of the components in modules are wearing out. Based on the findings, it is the researchers opinion that the following action should take place in order to continue a standards-based, student-centered program:

1. Evaluate all sixteen modules in the Mosinee Middle School Technology Education lab for alignment to the Wisconsin Model Academic Standards for Technology Education grade eight.
2. Evaluate all sixteen modules in the Mosinee Middle School Technology Education lab for student-centeredness according the district's strategic plan.
3. Those modules that are found to be lacking in alignment to the Wisconsin Model Academic Standards for Technology Education grade eight and student-centeredness would not be replaced when cost of repair is no longer effective.
4. Those modules that are found to be in alignment with state standards and are student-centered would be upgraded to the latest version. If a new version does not exist, replacing with a similar technology module is recommended.

5. If a gap in the curriculum is realized from modules that have been taken out of service, traditional technology education activities that are blended in between module rotations that reinforce the exploratory nature of the modular experience, are standards-based and student-centered, with the goal of helping students to become technologists.

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