The transformation of a middle school industrial shop to a modular industrial technology lab and communicating this transformation to the local community

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University of Northern Iowa

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The transformation of a middle school industrial shop to a modular industrial technology lab and communicating this transformation to the local community

Abstract
The purpose of this graduate project was to describe the transformation of a middle school industrial arts shop to a modular industrial technology lab and the subsequent public relations effort to communicate this transformation to the local community. This project facilitated a better understanding of what a modular industrial technology lab is, what it looks like, and how it meets the needs of the industrial technology curriculum.

A PowerPoint presentation was created to explain to the diverse audiences how the change from a traditional industrial arts "shop" class to a modular industrial technology lab at an intermediate school took place, what was needed to make it work, why the modular system (Synergistic Systems) was chosen, and the content of the modules selected for use in the lab.
THE TRANSFORMATION OF
A MIDDLE SCHOOL
INDUSTRIAL ARTS SHOP TO
A MODULAR INDUSTRIAL TECHNOLOGY LAB
AND COMMUNICATING THIS TRANSFORMATION
TO THE LOCAL COMMUNITY

A Research Project
Submitted to the
Division of Middle Level Education
Department of Curriculum and Instruction
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Education
UNIVERSITY OF NORTHERN IOWA

By
Lynn Figg
November 2004
This project by: Lynn Figg

Titled: The Transformation of a Middle School Industrial Arts Shop to a Modular Industrial Technology Lab and Communicating this Transformation to the Local Community

Has been approved as meeting the requirements for the Degree of Master of Arts in Education

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ABSTRACT

The purpose of this graduate project was to describe the transformation of a middle school industrial arts shop to a modular industrial technology lab and the subsequent public relations effort to communicate this transformation to the local community. This project facilitated a better understanding of what a modular industrial technology lab is, what it looks like, and how it meets the needs of the industrial technology curriculum. A PowerPoint presentation was created to explain to the diverse audiences how the change from a traditional industrial arts “shop” class to a modular industrial technology lab at an intermediate school took place, what was needed to make it work, why the modular system (Synergistic Systems) was chosen, and the content of the modules selected for use in the lab.
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THE TRANSFORMATION OF
A MIDDLE SCHOOL INDUSTRIAL ARTS SHOP
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AND COMMUNICATING THIS TRANSFORMATION
TO THE LOCAL COMMUNITY

Chapter 1

Introduction

As with any area of education, change has taken place in the field of industrial technology education. In the early 1900s, "manual training" was used to describe the course in which students were taught to identify tools, machines, and their processes. Students were required to know the proper task and method of use for each tool (Foster, 1997). In the 1920s, the name "manual training" changed to "industrial arts," but the same expectations for the curriculum remained. These types of programs were often referred to as "shop."

In the late 1980s there was a push for more progressive educational practices, hence the development of technology preparation ("tech prep"), career basics, and school-to-work programs. All of these programs were attempts to prepare students for post-secondary employment. The name of these programs has changed a number of times: from industrial arts, to industrial technology, and most recently, technology education.
As the name changed, modifications and changes to the curriculum, which were
to meet the changing requirements of education, eventually began to take place. The
latest of these curricular changes has been the incorporation of modular industrial
technology labs. Modular technology labs were starting to be marketed in 1989
(Synergistic Systems, 2003). One difference between the original “manual training”
course and the modular industrial technology labs is that there is not always a project to
take home, but the concepts of tool usage and when to use a certain tool are still being
learned by the students.

Rationale for the Project

Sometimes timing is everything to make a big change. In 1999 the industrial arts
shop at Walcott Middle School in Walcott, Iowa was scheduled for major remodeling:
losing square footage, a change in room layout, which would require or necessitate
modification of the curriculum. In 1994 the ninth graders were moved to the high school.
The room still reflected courses no longer being taught. The question posed by me was,
“Is now the time to consider a modular industrial technology system?” I also needed to
be sure that this was the direction technology education was going and if it was
appropriate for my students.

I knew the cost of the room renovation, wiring (both for electrical and data drops),
computers and furniture could be paid for by using the Local Option Sales Tax (LOST)
monies. This would be the greatest source of financial support for the switch from the
traditional industrial arts “shop” to the modular industrial technology lab. I also took into
consideration the cost effectiveness for the future. With all the pressure to reduce or
monitor program costs in education and the cost of supplies increasing every year, it was
important to determine the cost-benefit aspect of this change. I decided I needed to look
at what options were available and carefully analyze all factors.

The main benefit to using modular industrial technology systems is the ability to
present a vast amount of information in the four areas of industrial technology:
communication, manufacturing, transportation, and energy and power. In a modular
industrial technology lab, multiple workstations can be operating at the same time with
different modules of study being used at each workstation to offer a broad area of study.
Each workstation has a computer, work area, and materials specifically related to the
topic being explored in that particular module. For instance, one workstation may
contain the module, exploring the area of drafting, while at another workstation; students
are examining a four-stroke engine. If a student is interested in a particular area, they can
look at it more in depth to see what the nature of work is, the working conditions,
education requirements, and salary (See Appendix A for a complete list and description
of the modules).

I found numerous providers of modular hardware and software systems. On a
regular basis I would receive information in the mail from different companies promoting
their modular systems. Area distributors also sent brochures and salespersons to the
school explaining the different companies that they supported and the modules that were
available. I also visited several school districts that already had modular labs in place to
get a better understanding of how each system promoted the human growth and
development of a middle school student. When deciding which system to recommend, it
was important to see and speak with as many different students and educators as possible.
It was also imperative that I apply what I knew about seventh and eighth graders when I
selected various modules. Among those questions that I needed to address, were: What are their needs? What are their learning abilities and learning styles? What are the educational standards students are expected to achieve? What modules were available to help close the cross-curriculum gap? All systems had their pros and cons, so it was a matter of researching and choosing which modular system was best for the students based on my knowledge of my school’s population.

I began the search for the best system by visiting several schools with modular industrial technology labs. I started in Eldridge, Iowa at North Scott Junior High School. The lab in this school did not appear to be student-friendly. The software did not seem to guide the students through the activity and the students had a hard time understanding the manuals provided at each module. The instructor implied that the materials were designed more for high school students and not the middle school students.

The next stop was Washington Junior High School in Rock Island, Illinois. Just stepping into this lab had an immediate positive impact on me as a visitor. The students appeared to be more engaged in the learning process and worked cooperatively with their partner. The lab was set up in pods of four, unlike the first lab with equipment that lined the walls of the room. The modules were in a separate section of the classroom and, off to the side, were desks where the students began and ended each class period.

The main industrial technology modular system for this school was Synergistic Systems. There were a few modules included from other vendors, but the material and content of these modules did not seem as user-friendly as that of the Synergistic Systems’ modules. The instructor informed me that the non-Synergistic Systems’ modules were slowly being replaced to make a pure Synergistic Systems industrial technology lab.
My final site visit was to Millard North Middle School in Omaha, Nebraska. Expecting to see a different company represented, it was quite a surprise to see forty Synergistic Systems’ modules in one oversized classroom. All of the middle schools in the Millard School District were set up very similarly with the exception of some of the furniture. Again, this classroom had a separate section set up with student tables. It was referred to as the staging area. After seeing Synergistic Systems in action for a second time, the decision was made to purchase these modules for Walcott Middle School.

Now that the decision had been made, the difficult part was about to begin - how to fund the project. One part of funding for the project seemed quite easy. The Davenport Community School District was renovating Walcott Middle School with the funding of the Local Option Sales Tax (LOST) monies. LOST monies would pay for the room remodel, wiring (both electrical and data ports), furniture, and computers. This was indeed a great portion of the project, but a dilemma was still evident, “How to get the rest of the money needed to purchase the module software, equipment, tools, student materials, and printers?” LOST monies, by the nature of the law, could not be used on software or any curricular materials, including consumables.

Since building and district funding would not be able to cover such an extensive project, the only option that even seemed remotely possible was to write a grant for the remaining funds. The Scott County Regional Authority had become known for supporting technology in the schools. The grant proposal was written by Sherry Wilson (our building curriculum facilitator) and me. We then had the long wait before receiving word that the grant had been awarded to support the project. (See Appendix B for a complete copy of the grant).
After we received word that the grant had been funded, the next step was to order the modules, attend one week of training in Pittsburg, Kansas, and do quite a bit of trial and error experimenting just prior to usage and then during the first few months of implementation. Some students were asked if they would give up a few days of their summer to become "guinea pigs". They helped simulate a class to help me have a better understanding of what to expect as the entire program rolled out.

**Purpose of the Project**

The purpose of this graduate project was to describe the transformation of the industrial arts shop to the modular lab and to create an effective communication tool to inform parents, colleagues, curriculum councils in the area, school administrators, school board members, and fellow industrial technology instructors of the transformation. Many of these people had heard or read about the change, but they just could not visualize what a modular industrial technology lab was or what it looked like. Since the presentation was going to be about technology, I decided technology would be the most effective method to deliver my information. A PowerPoint (Microsoft®, 2000) presentation and script were developed to explain the reasons for the change from "shop" to a modular lab approach. I was able to share some of the key advantages of working in a modular industrial technology lab. When presentations were made "on site" the audience would be invited to take a tour of the classroom and actually work on some of the modules in the lab. Information was gathered for the presentation from the supplier of the modules (Synergistic Systems, 2003), published journals, articles and books interviews of other educators using modular industrial technology labs, and my personal experience after
using the modules with my classes. The information was then scaled down to the key factors about the lab at Walcott Middle School.

Although the program was initially planned for an audience of industrial technology educators, it has since been modified for diverse groups of people ranging from educators of different subject areas, administrators, curriculum council members, school board members, and parents. The PowerPoint (Microsoft®, 2000) presentation has become a true resource to me (See Appendix C for printed slides and Appendix D for a CD of the presentation). With continued modification for the length of the presentation, the PowerPoint (Microsoft®, 2000) has become the best way to describe the new lab.

**Terms and Definitions**

In order for readers to have a common understanding of the topic, the following definitions are provided.

**Consumables** – Supplies that are used by the students to complete a hands-on activity. These supplies are not reusable.

**Cooperative Learning** – Students work collaboratively in pairs to complete the curriculum and activities; teamwork and communication are a valuable part of success in each module (Synergistic Systems, 2003).

**Discovery Days** – Between module rotations, the teacher leads the class in small or large group activities (Synergistic Systems, 2003).

**Enrichments** – After a student has completed the learning activities and hands-on experiences they are given the opportunity to do an enrichment activity. Global, career, math and science activities require students to apply content knowledge to new challenges (Synergistic Systems, 2003).
Industrial Arts – “Those phases of general education which deal with technology, its evolution, utilization, and significance; with industry, its organization, materials, occupations, processes, and products; and with the problems and benefits resulting from the technological nature of society” (Maley, 1973 p. 2).

Lab Manager – A student that acts in a “supervisory” position; handing out supplies, equipment and worksheets as needed.

Module – Unit of work in a course of instruction, which is virtually self-contained, e.g., a course in technology might consist of several independent topics. Modular courses are used where limited equipment or resources makes it desirable that several modules shall be taught at the same time on a rotational basis (Page & Thomas, 1977).

Research, Challenges, & Applications (RCAs) – Used as part of the learning process in each module. These are a series of questions to focus on: 1) Fundamental research about the module topic, 2) Challenges (charts and graph reading), and 3) Applications of math and science relevant to the module topic (Synergistic Systems, 2003).

Rotation – the number of modules a student can work on during a quarter or semester class. This number is determined by the instructor, depending on the other requirements of the class(es).

Session – each day of a module rotation for a total of seven days (Synergistic Systems, 2003).

Staging Area – classroom area where the students are seated at tables or desks away from the actual modular workstations.

Student-Directed Learning – students become more responsible learners, are empowered, and to take ownership of their learning (Synergistic Systems, 2003).
**Synergistic Systems** – Introduced in 1989, to middle school education; delivers curriculum digitally, and offers a hands-on approach to learning math, science, and technology (Synergistic Systems, 2002).

**Technology Education** – an educational program that helps people 1.) develop an understanding and competence in designing, producing, and using technology products and systems; and 2.) assess the appropriateness of technological actions (Wright, Israel, & Lauda, 1993).

**Workstation** – the area in which the computer, support materials, and equipment are located for each module topic and where the students complete the activities.
Chapter 2

Review of Literature

Industrial Arts has long been a vital part of school curriculum. It was once used as a means of teaching young men vocational skills and developing leisure time interests. Today, industrial arts is taking technology a step further and introducing students to the concepts of industrial manufacturing, transportation, communication, and power through the use of modular industrial technology labs. Industrial technology education has opened its door to all students and through the use of modular labs, allowed more opportunities for at-risk students and students with learning disabilities to explore a vast and rich curriculum that was once only available to a small student population.

Evolution of Industrial Arts

Calvin Woodward was known as the “father of manual training.” He established the St. Louis Manual Training School (Foster, 1997; Coats, 1923). The manual training school had three purposes: 1.) keep boys in school, 2.) provide vocational skills, and 3.) develop leisure-time interests (Foster, 1997; Gerbracht & Babcock, 1969). During the 1920s “manual training” changed to “industrial arts” and was promoted as a product of the progressive education movement with the concept of learning by doing (Butts, 1995). Industrial arts was an area of education that really hadn’t changed much since the initial programs started in 1876. In later years the emphasis was put on basic construction and manufacturing principals, processes, and materials. This delivery system mirrors what many still think industrial technology means today.
The push for change in education in the 1980s lead to a change in industrial arts. Now known as “technology education,” the new emphasis on applied academics, seemed to be a natural fit for a modular laboratory instructional program (Foster, 1997). A modular topic is a unit of instruction which is virtually self-contained (Page & Thomas, 1997). The module system focuses on applied academics of math, science, and technology, plus daily hands-on activities meet the standards set by education (Pitsco, Inc., 2002). In fact, Synergistic Systems takes pride in relating the skills developed through each module to nationally recognized standards and benchmarks. The standards for technology education include areas such as the characteristics and scope of technology, core concepts, the effects of technology on the environment, and attributes of design (Pitsco, Inc., 2003) (See Appendix E for full list of the Industrial Technology Education Association Standards).

Teaching Reforms

An increasing number of educators and researchers have called for higher standards and more challenging activities, especially for students who are at risk of failure due to poverty, race, language, or other factors (Ogle, 1997). Reform initiatives of the 1990s have required educators to re-think America’s traditional school model where all students learn and retain information in the same way. Educators and policymakers have called for a change in teaching and learning models: schools should emphasize more active student learning (Sheingold, 1990) and revise the teacher’s role from “dispenser of knowledge” to “facilitator of learning” (Wiburg, 1991). When learners are put in a cooperative, student-centered setting they become more responsible for their own learning, and they become more successful at knowledge transfer and creative problem
Researchers have proposed a move from teacher-centered teaching toward student-centered or constructivist classrooms (Brooks & Brooks, 1993; Caine & Caine, 1991; Elmore, 1990; Marshall, 1992; Sizer, 1992).

Constructivist teaching and learning models emphasize the context in which an idea is taught as well as student's prior experiences and attitudes. The constructivist model also indicates that the activities and contexts should be meaningful to students so they will make connections between classroom learning and the world outside the school (Means & Knapp, 1991; Means, 1997). Teaching that is aimed at understanding and applying ideas has proved more effective than rote teaching for students. Students engaged in hands-on learning opportunities, projects, discussions, and research aimed at higher-order thinking are better able to remember and apply what they learned than rote learners (Darling-Hammond, 1997). Darling-Hammond (1997) stated, “to engage students in critical thinking and production, tasks should represent real performances in the field of study (not bite-sized pieces of work that are several steps removed from an actual performance)” (p. 108).

Modular Labs

A number of different modular systems are available for schools today covering a number of different topics. Each system has benefits and drawbacks. It is imperative that the characteristics of a system match with specific student and school curricular needs. For the purpose of this research project the only company that will be named will be the system that was installed in this particular middle school. All other companies will be anonymously identified. All companies that were researched were looked at with an open mind. Company A's modules were 1.) Strong in the area of communication, with
little variation beyond that; 2.) Set up as a stand-alone system, 3.) Initial cost was very comparable, with very few consumables needed, and 4.) Tech support was available, but to what extent is unknown. In Company B’s case 1.) It had a wider variety of modules, but very few related to industrial technology; 2.) The curriculum was designed more for the high school level; 3.) System was set up to be networked to a management station; 4.) Cost to set up the system was slightly higher due to the networking requirements, consumables needed seemed to be on the expensive side; and 5.) The tech support was available from the distributor of the product. Company C’s system was 1.) More of the “suitcase” system, where you just set it up on a bench when it is in use; 2.) Curriculum seemed to be geared more to the high school level; 3.) This was also a stand-alone system; 4.) This system was very affordable, and 5.) Tech support for this company is unknown. The company that was chosen had 1.) A wide variety of modules relating to industrial technology; 2.) The curriculum was developed and geared toward the middle school aged student; 3.) System is networked with a management system; 4.) The initial cost of the system was comparable to the other company that offered the network system, and consumables are available directly from the company at a reasonable cost; 5.) The training and tech support of this company is a very strong component for the success of their modular lab.

Modular Lab System that was Implemented

Synergistic Systems (Pitsco, Inc., 2002) has developed a student-centered learning environment that encourages higher order and critical thinking skills using problem-solving techniques. Pitsco, the company which developed the Synergistic Systems' modular industrial technology labs focuses on using student-centered and module-based
curriculum. Cooperative learning modules in the Synergistic Systems’ lab guide pairs of students during seven-sessions of hands-on learning at workstations complete with supplies and equipment. As of March 2002, more than 2000 systems were being used in schools across the nation (Synergistic Systems, 2002).

The Synergistic Systems learning module (Pitsco, Inc., 2002) can be broken down into four parts: 1.) Content is delivered to students through interactive multimedia of video, text, graphics, and animation explaining the concepts and directing the activities; 2.) Elements of math, science, technology, career, reading, and research are integrated into the content; 3.) The hands-on activities enable students to explore and apply concepts they are learning; 4.) Students work cooperatively in pairs to complete the activities, adding the social aspects of teamwork and communication to what they are learning (Synergistic Systems, 2003).

Student-centered learning in a controlled setting requires students to be able to explore, review, and carry out assignments and solve problems in pairs without dependence on the teacher. Testing and review are also accomplished through each module’s computerized programming, placing further responsibility on the student for learning. The modular industrial technology labs were developed by a former industrial technology teacher. The flexibility of the presentation of module information and the inclusion of problem solving activities accommodates different student learning styles, students who require special modification and accommodations to be successful in regular education, and helps all students to be successful.

Three claims made in Pitsco’s literature (Pitsco, Inc., 2002) about the end result of the use of their product is that students in Synergistic’s learning environment will: 1.)
Become life-long learners and be more motivated, disciplined and organized; 2.) Develop their learning skills by following instructions, applying new knowledge, and connecting reading, research, communications, and technology; 3.) Build teamwork and cooperation skills by contributing and communicating within a team, developing management skills and developing an appreciation for diversity. The literature also states that each segment of Synergistic Systems' modular industrial technology lab is designed, researched, and tested to keep these overall goals for student education in mind.

The Pitsco design of Synergistic Systems is based on the premise that students retain more when their learning is linked to everyday experiences (Dean, 1997). With this in mind the learning modules connect principles of the module (math, science, consumer education, among others) with things in the students' everyday life as well as background knowledge. The topics in each module are also created with a focus on the future employment market.

How the Synergistic Systems' Classroom Operates

In a Synergistic Systems' classroom, students follow a “Module Framework” for seven days. The students record their own attendance on the computer and gather the necessary things for the day's activities. At their workstations, students do a knowledge survey in the form of pre-test, or a Research, Challenges and Applications (RCAs) activity (questions related to math, science, and language which are completed on four of the seven days of the module), test review, and finally a post-test. Sixty percent of classroom time is spent in content exploration with a partner through multi-media and multi-modal experiences. Students engage in hands-on activities, experience computer
applications, and view video segments. For those students who complete their work early, there are enrichment and enhancement activities available on a daily basis. According to Pitsco, Inc. (2002) Synergistic Systems’ modular lab is advantageous for students for many reasons: a diverse array of learning opportunities allows students to explore new technologies, careers, and curriculum areas through a modular lab. In a modular lab setting, teams of students will work together cooperatively and collaboratively to investigate topics such as CADD, robots, and engines. The modular lab can serve a comprehensive group of students: students with special needs, those considered to be at-risk, and also the gifted population of the school can all be actively engaged and successful learners within the modular lab setting. Allowing students to explore and to apply science and math in real life settings and context through technology, promotes success for all students by delivering concentrated, multi-sensory, multi-model, hands-on learning.

In Conclusion

Since as far back as the early 1900s, a focus of industrial technology has been to teach young people the importance of vocational jobs and leisure time activities. With modular industrial technology labs, schools have the ability and opportunity to introduce technology to a wider variety of students and expose students to areas that were never before explored. Modular technology education has enabled schools to accurately reflect skills needed for students to be successful in the "real world". It allows the vast variety of skills to be taught in a cost effective manner.
Chapter 3

Methodology

The purpose of this project was to describe the transformation of an industrial arts shop to a modular lab at Walcott Middle School and the creation of a communication tool to inform the local community of the change. Explaining the transformation verbally, without visuals, was a barrier to effective communication. In the beginning, this project was only intended to be presented to two groups of people: 1) The Iowa Curriculum Council and 2) Industrial Technology Teachers in the Davenport School District. As the work on the presentation started, it became apparent that different groups, such as parents, school administrators, and fellow teachers were interested in knowing more about the transition. It became evident to this author that a presentation with a visual component would be needed to showcase effectively the transition from the old lab to the new modular lab to all of the interested parties. PowerPoint (Microsoft®, 2000) software appeared to be the best delivery system available. The visual images of the transformation process could be presented with PowerPoint and the use of technology to present the new industrial technology lab appeared to be an appropriate "fit". Since the initial presentations, this projects’ PowerPoint slides and script have been presented to Davenport Schools’ principals and upper administrative staff, the school board of the Davenport School District, Eastern Iowa Curriculum Council, Walcott Middle Schools’ PTA, and the parents of the students enrolled in the class, Industrial Technology.

Information for creating the PowerPoint presentation was gathered from different resources including the company, articles and books, interviews of teachers using modular lab systems, and personal experiences of this author. The information was put
together for the PowerPoint presentation in chronological order from how the idea of changing to a modular lab system started, to the purchase and the implementation of the chosen system. The PowerPoint presentation provides a day-by-day description of learning activities in the modular lab, shows how learning styles and curriculum are integrated, lists all modules, and demonstrates how the management system works.

A Davenport Community Schools’ Photo/Video Permission Slip was sent to the parents of any student photographed for the PowerPoint presentation (See Appendix F for a sample of the permission slip.) This PowerPoint presentation will continue to be modified to keep it current and to meet the diversity of the groups to whom it is being presented.
Chapter 4

The Project

A PowerPoint (Microsoft®, 2000) presentation was developed to show exactly what a modular industrial technology lab is, why Synergistic Systems was the product of choice, and how it was implemented at Walcott Middle School in Walcott, Iowa. In order to be able to present the concept of the new lab to a diverse population consisting of administrators, colleagues, and parents a comprehensive PowerPoint presentation was developed. The slides and narrative script follow. The printed versions (with text, photographs and graphics) are printed in Appendix C. A CD with the PowerPoint (version 9.0.3821), (Microsoft®, 2000) presentation is provided in Appendix D. The software needed to access the PowerPoint presentation contained in the Microsoft Windows 2000 software (Version 9.0.3821), supporting the PowerPoint program.

Slide 1 Text:

Walcott Middle School

The Change From Traditional Shop Classes
to
Industrial Arts
to
Modular Industrial Technology Labs

By Lynn Figg
Slide 1 Narrative:

Hello, I am Lynn Figg. Welcome to my presentation on the transformation of my class previously referred to as “shop” or “industrial technology lab” to our new class, the “modular industrial technology lab.”

Traditional industrial technology is what many of you may have called “shop” in your school. Thirty years ago “shop” may have included working on cars, working with wood and metal to create furniture and/or castings, and drafting. Fifteen years ago you may have seen more changes, such as more women involved in this area, technology-enhanced tools and the term “shop” was now being referred to as “industrial arts.” About ten years ago “industrial technology” was introduced as the new name for “industrial arts” to keep it current with what was happening in society. This was also when more computerized equipment became available and utilized in the schools. “Technology education” is the preferred term of today, but I’ll use “industrial technology” in this presentation.

Slide 2 Text:

Background Information
Lynn Figg

-Teaching for nineteen years in the Davenport Community School District

-All but two years have been in the area of Industrial Technology

-Developed curriculum for advancing technology
Slide 2 Narrative:

Just a little background about myself. I have been teaching for nineteen years in the Davenport Community School District. During this time I have taught at five of the six middle schools and all but two of these years have been in the area of industrial technology. For two years I taught art at one of the middle school buildings. I currently teach only industrial technology at Walcott Middle School.

I have been involved with my colleagues in developing curriculum to try to keep up with the advancing technology of today. One of the biggest changes has been the incorporation of computers in the area of industrial technology. At one time, my colleagues in industrial technology developed activities to go along with any software or hardware that we could find! We used Apple IIEs, Apple IIGSs, and Macintosh computers. Any software or hardware was a treasure!

Slide 3 Text:

Curriculum Innovations
- Modular Systems
- Modular Industrial Technology Labs
- What is a Modular System?

Slide 3 Narrative:

About 15 years ago, I joined a group of the industrial arts middle school teachers from the Davenport School District and we went on a site visit to DeWitt, Iowa during one of our in-service days to look at a new type of instructional program: modular
industrial technology labs. It was one of the first modular systems in this area, and it was the first time I ever saw an industrial technology lab of this nature. I just remember the room didn’t look like a “shop” that I was used to, but yet the students were doing technology-type activities, such as hydraulic simulations.

**Module Definition**

A student-directed module is delivered at self-sufficient workstations that accommodate everything students need to complete their activities

-Synergistic Systems, 2003

Unit of work in a course of instruction, which is virtually self-contained, e.g., a course in technology might consist of several independent topics. Modular courses are used where limited equipment or resources makes it desirable that several modules shall be taught at the same time on a rotational basis.

- Page & Thomas, 1977

**Slide 4 Narrative:**

Many people do not know what a modular system is. The best definitions that I have come across are: A student-directed module is delivered at self-sufficient workstations that accommodate everything students need to complete their activities (Synergistic Systems, 2003). And, unit of work in a course of instruction, which is virtually self-contained, e.g., a course in technology might consist of several independent topics. Modular courses are used where limited equipment or resources makes it desirable that several modules shall be taught at the same time on a rotational basis. (Page & Thomas,
1977). A module is topic driven such as robots, or graphic communications. All the information for the topic is at one specific location or workstation in the classroom.

After our visit to DeWitt, Iowa, most of us liked the modular system and were interested in doing something similar in our buildings. We were not able to do this, because the funding was not available to do all six middle school buildings—it was either all or none. But, this was the start of the curriculum change I talked about earlier; incorporating computers into industrial technology.

Slide 5 Text

My Opportunity Arises!!!

-Renovation to Walcott Middle School

-Creating a different space in the industrial technology lab

Slide 5 Narrative:

Walcott Middle School was having some major renovations done in the summer of 2000. With this renovation, a hallway would need to be put through my classroom to create an exit for a new classroom being put in next door to the industrial technology lab. Needless to say, I became quite involved in this process to make sure that I lost the least amount of floor space possible. I worked with the architect, the job superintendent of the construction company, the head of the district maintenance department, and the building principal. After the final drawings were completed for my area of the building, district administrators brought to my attention that if I would like to look into replacing my
traditional equipment with a module type lab, now would be the time to do it. They did not have to suggest this to me twice.

Slide 6 Text:

Search for the Right Modular System

-North Scott Junior High School, Eldridge, IA
-Washington Junior High School, Rock Island, IL
-Millard School District, Omaha, NE

Slide 6 Narrative:

My hunt was on for the best modular system available. There are many different companies that offered a wide variety of modules from which to choose. I decided that instead of contacting sales representatives (who would try to sell the product), I would try to see as many different types of modular labs that were already in use around the area. I felt that I would get more of an honest answer to some of my questions from fellow educators versus the salesperson who wanted to make the sale.

Slide 7 Text:

North Scott Junior High School
Eldridge, Iowa

-Entire classroom with modular labs
-Not student-friendly
It had been quite a few years since I had seen a modular lab, so I needed to find a school district that had implemented something similar to what I was looking for. My first stop was to North Scott Junior High School in Eldridge, Iowa. Their system had been running for two years at that point. The instructor told me that some of the modules were geared for the high school, but they bought them to “fill-in” the lab. As I was walking around the room I started to thumb through some of the manuals located at each station. They were not kid-friendly at all. In fact some were hard even for me to understand what needed to be done.

The next school I visited was Washington Junior High School in Rock Island, Illinois. I walked into the lab and was totally amazed. I was expecting to see something similar to what I saw in North Scott, but to my surprise it was quite different. The workstations were set up in pods of four, with some workstations running along the wall. The students were all actively working on different things. They were working with a partner trying to solve a problem, working through an activity, or constructing a product. Whenever I asked the students what they were doing, they could explain it to me-
sometimes in great detail. They were using a product from a company called Synergistic Systems (Pitsco, Inc., 2002). The main things I remember from the conversation with this instructor was that: 1.) Synergistic Systems’ modules were designed and developed for the 7th and 8th grade student, 2.) the modules worked well in a 40 to 45 minute block of time, (which is what our school uses for class periods), and 3.) the tech support was reported by the instructor to be wonderful (even four years after they had purchased the first modules from the company).

Slide 9 Text:

Millard School District
Omaha, Nebraska
-Synergistic Systems’ modular labs
-40 stations

Slide 9 Narrative:

The retired superintendent of the Millard School District, in Omaha Nebraska was very instrumental in the getting a modular industrial technology system in all of the middle schools of the Millard School District. The superintendent’s neighbor just so happens to be my brother-in-law, so my brother-in-law told him of my interest in installing a modular industrial technology lab at my school. About a week later I received a phone call from my brother-in-law informing me that his neighbor arranged for me to see one of the six labs. So, my final school site visit was to the Millard School District in Omaha, Nebraska.

I was expecting to see a different modular system, but to my surprise it was the same system in Rock Island, Synergistic Systems, only it was twice as big. They had 40
stations, up to 40 students in the class, and two instructors. During my visit to Millard, I had more time to speak with an instructor, since there were two of them. The teacher basically reiterated the same things as the instructor from Rock Island had said about Synergistic Systems. Synergistic Systems had been running in the Millard School District for approximately six years. After returning to my school the following Monday, I told my principal that I thought that I had found the system that would be best for our building.

Slide 10 Text:

How Our Modular Industrial Technology Lab Became a Reality

- Local Option Sales Tax (LOST)
- Scott County Regional Authority

Slide 10 Narrative:

After deciding that Pitsco’s Synergistic Systems was the best industrial technology modular program to install in my building, I needed to determine where all the money would come from to fund this project. The renovation of the original classroom was paid by the Local Option Sales Tax monies. This money included any construction in the room, furniture, and hardware (computers only).

I still needed to figure out where to get the money for the software, equipment, curricular materials (station library and worksheets), and supplies. The only way to do this was to look into an outside source of money. The Scott County Regional Authorities have been known to give quite a bit of money for technology in education, so with the
help of our building facilitator, we wrote a grant for the funding. We were awarded the grant in late November, 2001. Up to this point we had been working with two sets of building plans for my area. One set was for a traditional shop and the second was for the modular lab. It was a good thing the construction crew was running about four months behind schedule.

Slide 11 Text:

<table>
<thead>
<tr>
<th>Why Synergistic Systems?</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The curriculum is student-centered</td>
</tr>
<tr>
<td>- Age appropriate yet adaptable</td>
</tr>
<tr>
<td>- The curriculum is module-based or topic-based</td>
</tr>
<tr>
<td>- Workstations are self-sufficient</td>
</tr>
<tr>
<td>- Students work cooperatively in pairs</td>
</tr>
<tr>
<td>- Each module is based on the same framework or routine</td>
</tr>
</tbody>
</table>

Slide 11 Narrative:

As I stated earlier, Synergistic Systems is very student-centered. It had been developed for the middle school-aged student in a time frame that matched our class periods of 45 minutes. The curriculum was module-based. This means that each workstation focuses on a specific learning topic or “module” of study. Topics include areas such as *CADD, Light and Lasers, Electricity*, and *Rocketry and Space*. Everything related to the module takes place at that workstation. Students work cooperatively in pairs to solve problems, create a product, or to work through the activity of the day. Modules take seven days to complete and they are based on the same basic framework, or set of tasks for each module. The workstations are self-sufficient, so that all materials
students need can be found in the workstation, in the station library, or explained or
demonstrated on the computer.

Slide 12 Text:

<table>
<thead>
<tr>
<th>The Law of 2 x 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 students per station</td>
</tr>
<tr>
<td>for 7 sessions (days)</td>
</tr>
</tbody>
</table>

Slide 12 Narrative:

There are two students assigned to each workstation for seven days. Each day is
considered a session. At the workstation, students work on a module of study.

Slide 13 Text:

<table>
<thead>
<tr>
<th>The Framework of Each Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Assessment Time</td>
</tr>
<tr>
<td>-Hands-On Activities</td>
</tr>
<tr>
<td>-Enrichment Activities</td>
</tr>
</tbody>
</table>

Slide 13 Narrative:

The framework for each module and for each session is the same. The first ten
minutes of the session is dedicated to knowledge survey – or assessment time. This time
would be similar to taking a quiz or test to make sure that the students are understanding
the module that they are working on. After the knowledge survey, students do a hands-
on activity. This usually takes from 20 to 30 minutes of class time. If time permits, the students are able to do an enrichment activity to enhance their learning.

Now I will share with you what students experience as they proceed through sessions 1 through 7. Although each of the pairs of students may be working on a different topic in industrial technology, they all go through the same procedure in each module.

**Slide 14 Text:**

<table>
<thead>
<tr>
<th>Session 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Pretest</td>
</tr>
<tr>
<td>- Individual Test</td>
</tr>
<tr>
<td>- Library time</td>
</tr>
<tr>
<td>- Hands-On Activities</td>
</tr>
<tr>
<td>- Designing CO2 cars</td>
</tr>
<tr>
<td>- Enrichments Activities</td>
</tr>
</tbody>
</table>

**Slide 14 Narrative:**

The pre-test of ten questions is the first knowledge survey. During this time the students are working individually to identify what they know and don’t know about the particular module they are working on. While one student is taking the test their partner is reading from the “library” found in their workstation. The points from the pre-test do not count on the final module grade, since it is just a check to see what the student knows and doesn’t know yet. After both students finish the pre-test, they start the hands-on
activity for the day, such as designing a CO₂ car in the Research & Design module. Time permitting, they may choose an enrichment activity.

Slide 15 Text:

<table>
<thead>
<tr>
<th>Sessions 2, 3, 4, &amp; 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>-RCA Questions</td>
</tr>
<tr>
<td>-Research</td>
</tr>
<tr>
<td>-Challenge/Chart</td>
</tr>
<tr>
<td>-Application of Mathematics</td>
</tr>
<tr>
<td>-Hands-On Activities</td>
</tr>
<tr>
<td>-Solar hot dog cooking</td>
</tr>
<tr>
<td>-Controlling remote robot</td>
</tr>
<tr>
<td>-Milling project</td>
</tr>
<tr>
<td>-Enrichments Activities</td>
</tr>
</tbody>
</table>

Slide 15 Narrative:

For the next four days the students will be doing RCAs. Each letter stands for a different type of question. The three questions are each worth ten points. The RCAs are always the same types of questions.

R – is for Research. The students are asked a question that will most likely need to be looked up in one of the module library books, unless of course they have prior knowledge in this area.
C - is for Challenge. Students are shown a chart or graph and asked a specific question that they need to use the chart to correctly answer it. Sometimes they have to study the chart fairly close to get the correct answer.

A - is for Math Application. A student is usually given a story problem to solve.

The students work with their partner to figure out the correct answers. One nice feature of the system is that even though they are working with a partner they can choose to not agree with their partner and select their own answer. There are two opportunities to answer the question correctly. If the student answers the question correctly the first time they receive ten points, if they answer it correctly the second time they receive five points. On the RCA questions, the students receive anywhere from 0 to 30 points each day.

After the RCAs, which take about ten minutes, the students will do the activity of the day. Some examples of hands-on activities would be in Energy, Power, and Mechanics in which the students learn about solar energy. During one session they cook a hot dog in a solar hot dog cooker. This day is always a big hit for the students. Another activity would be controlling a remote robot by watching the movement on a television screen in the Robots module. In the module, Digital Manufacturing, students learn how to program a mill using the computer and the provided software. After the mill program is complete, the final task is to mill their image in a piece of styrofoam. Time permitting, the students may choose an enrichment.
Slide 16 Text:

Session 6

- Test Review
- Game Format
- Multiple Choice
- Definitions
- Hands-On Activities
- Designing a house
- Using a laser and mirrors
- Enrichments Activities

Slide 16 Narrative:

During session six, the students do a test review. It is set up in the form of a game. The review has two parts, the first part is multiple choice. The student that keys in the fastest gets the first shot at the correct answer. If the first student misses, the second person gets a chance. In the second part of the test review, a definition comes up on the screen and different words appear as possible matches. When a student thinks the correct word is being displayed, they key in. The points they receive on the test review do not count on their final grade.

After the test review, they do an activity for the day such as designing a floor plan in CADD or using a laser and mirrors in Lights and Lasers in a reflection activity. They may do an enrichment activity if they have time.
Session seven is the final day of the module, so the knowledge survey is a post-test. There are ten questions and each question is worth ten points. As in session one, the students work individually on the post-test. After the students have completed the post-test, they do a hands-on activity such as a virtual reality scene in *Computer Graphics and Animation*. They may then work on an enrichment activity.

-Enrichments
  -Career Investigations
  -Math/Science Enrichments
  -Internet Research
  -Bloop (game)
Slide 17 Narrative:

You have heard the word enrichment at the end of each of the session descriptions. An enrichment is an extra activity that the student may do for extra credit points as time permits. I have assigned different point values for each enrichment activity. These point values are posted in the manuals at their workstations. Students use the enrichments to improve their other scores.

Each set of enrichment activities includes several options. Career investigations is a list of six to ten careers that are related to the modular topic that the student is currently working on. There are specific questions about the career such as: job description, working conditions, related jobs, and salary. Other enrichments include math/science problems related to the module, internet research, book reviews (using the books at their workstations), and Bloop (similar to the Connect Four game). Although Bloop is a game, it reinforces the terminology used during the module. Bloop is set up so that the vocabulary words are only those that are related to the current modular topic the student is working on. I've noticed students who play this game seem to do much better on their post-test.

Slide 19 Text:

<table>
<thead>
<tr>
<th>Learning Styles</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Visual</td>
</tr>
<tr>
<td>-Auditory</td>
</tr>
</tbody>
</table>

Slide 19 Narrative:

Another nice feature of Synergistic Systems is that it meets the needs of all the different learning styles of my students. For visual learners, this is done in two different
ways. The students will be able to see a person demonstrate what they are to do on the computer screen. If a student does not understand or the video moves too quickly, they can just rewind it and start again. They can also pause it at any time to do the activities in that segment. The other visual support is an outline with step-by-step directions posted on the computer screen for the students to read.

A learning support for the auditory learner is the audio recording provided for each activity. As you have seen in the pictures, the students are wearing headphones. They are listening to a verbal description or instruction about the activity.

Integrated Curriculum

- Technology
- Math
- Science

All of the modules that I selected for our lab are technology-based and many emphasize math and/or science. We have seen a growth in the Iowa Test of Basic Skills in the areas of math, science, and reading at Walcott Middle School. Part of this might be attributed to our students working on this system
### Slide 21 Text:

#### Modules

<table>
<thead>
<tr>
<th>Communication</th>
<th>Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Digital Design</td>
<td>-Engineering Towers</td>
</tr>
<tr>
<td>-Digital Video</td>
<td>-Simple Machines</td>
</tr>
<tr>
<td>-Graphic Communication</td>
<td>-Robots</td>
</tr>
<tr>
<td>-CADD</td>
<td>-Digital Manufacturing</td>
</tr>
<tr>
<td>-Computer Graphics &amp; Animation</td>
<td>-Research &amp; Design</td>
</tr>
<tr>
<td>-Package Design</td>
<td>-Practical Skills</td>
</tr>
<tr>
<td>-Creative Solutions</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transportation</th>
<th>Power &amp; Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Flight Technology</td>
<td>-Lights and Lasers</td>
</tr>
<tr>
<td>-Digital Transportation</td>
<td>-Electricity</td>
</tr>
<tr>
<td>-Rocketry and Space</td>
<td>-Engines</td>
</tr>
<tr>
<td></td>
<td>-Energy, Power and Mechanics</td>
</tr>
</tbody>
</table>

### Slide 21 Narrative:

When selecting the modules for the lab, I wanted a nice variety with a strong emphasis in industrial technology. We have modules that relate to communications, manufacturing, transportation, and power and energy. These are four key components of technology.
### Slide 22 Narrative:

Since Synergistic Systems' modules are to be done with a partner, we only have a lab manager when there is an odd number of students in the class. The computer automatically assigns a student the job of lab manager as part of the master class schedule. The student is lab manager for seven days and then another student is assigned to do it. I tell them it is like holding the position of a supervisor at a job. Their responsibilities include: 1.) passing out all worksheets and module guides throughout the seven days, 2.) bringing any necessary equipment to the workstation, 3.) acting as a peer tutor, 4.) taking the place of an absent student, 5.) orientating new students, and 6.) keeping a daily log of their activities. They receive a grade based on their attendance and if they were actively engaged in the role of the supervisor for the seven days. If there is no lab manager assigned for the class I take on the role in addition to being the facilitator of the class.
Slide 23 Text:

Discovery Day

- Between each rotation
- Same problem for all
- Away from the workstations
- Problem solving

Slide 23 Narrative:

Discovery Days is/are the day(s) between rotations. During this time we are not in the module lab, but in the staging area. A Discovery Day can be any time length that the project may take. The projects range from a hands-on building projects, such as a sheet metal tool tray, to a problem-solving activity, such as creating an eraser car. All the students work on the same problem or project. If we are doing projects that require teamwork, I allow the students to pick their partner or team members. Having the students do a Discovery Day between modules allows any students who were absent to catch-up, it also gives me an opportunity to record the assessments and any extra credit work that was completed into the management program. It also gives the opportunity for me to do some large group instruction on hands-on projects that I feel are of great benefit to the students, especially those students who will be continuing their studies in industrial technology at the high school level.
Industrial Technology as We Knew It

Two student pictures working doing project work

Students still do some traditional projects in the industrial technology classes. Depending on the class, students will do a number of different projects using the materials of wood and sheet metal. They will also do some electrical and drafting projects.

- Schedule Screen
- Grading Screen

Synergistic Systems include a student management software program. Class rotations, partner assignments, and lab managers are assigned, if necessary, as part of the initial class set up. Passwords for the students are established and module rotations are assigned. Points for each session are calculated in this program. I can even tell a student how long they worked on the session for the day. With this program, I can print out a progress report for each student at the end of each rotation. I can also put in points for
extra credit, Discovery Day activities, or the extra modules that I added to the class activities.

Slide 26 Text:

Questions
and
Exploration Time!

Slide 26 Narrative:

I am able to answer questions at this time. After all questions are answered, you will have an opportunity to experience the lab as the student would, working through each session in the demonstration mode of a module. This demonstration program was also provided by the company.
Chapter 5

Conclusions and Recommendations

At the time of this writing, I have been extremely pleased with how the students collaboratively and cooperatively with their partners to complete the curriculum and activities on the module. The students always seem eager to get started with the class and don’t always want to leave the lab at the end of the period. Everyday is also a learning experience for me. Just when I think that I’ve seen every possible problem and answered every imaginable question, I am surprised by something new. In the beginning there were quite a few late nights getting things organized and going through parts of the modules.

I was asked by the district’s Director of Curriculum and Instruction to make a presentation to the Eastern Iowa Curriculum Council about our modular industrial technology lab. I kept coming up with different ways to explain the modular system to them. Since I was unaware of the background knowledge of my audience concerning the use of modular technology, I didn’t even know where to begin. A picture was going to be more powerful than words to describe my new classroom, so I decided to do a PowerPoint (Microsoft®, 2000) for the presentation. With the presentation in this format, it helped keep me on track, focused on the important facts of the modular system, and provide a concise outline of the steps necessary to achieve my vision.

Recommendations

Upon completion of this project I have considered some recommendations, not only pertaining to the presentation, but also for anyone interested in implementing a modular industrial technology lab in their school.
1. **Prepare for difficulties.** When presenting using a multimedia presentation, the presenter is at the mercy of the equipment and the availability of electrical power. When the presentation is someplace other than the home building, special challenges can arise, from ill-placed outlets to equipment failure. It is recommend the presenter come prepared with printed copies of the slide show.

2. **Make arrangements to visit a modular lab.** Anyone interested in a modular industrial technology lab, should take the time to investigate the labs in action. Visiting with other instructors is not enough. A site visit should be scheduled during a time when students will be actually using the equipment. Ask the students what they think of the system. I have had Synergistic Systems modules up and running for only three years, and I have had the faculty from a number of schools and upper administration from two districts, besides the administration of my own district, come to visit the lab.

3. **Allow time to visit with instructor.** Set up your visit time so that you can talk one-on-one with the instructor, especially about which modules they would recommend and which ones might not be as appropriate for the grade level of students enrolled in your classes.

4. **Purchase vendor recommended hardware.** Another key point is the hardware. If at all possible, purchase the computers that have been recommended by the vendor. It saves valuable time when it comes to troubleshooting software problems. This reduces the possible range of problem variances and the possible cause can be linked to the things that the vendor is responsible to fix.
5. **Check on the tech support for the modules.** Synergistic Systems, has provided superior technical support. If a piece of equipment has gone down, all that is needed is a quick call to their 800 number. If the problem could not be solved over the phone or they feel the equipment for the module is failing, a new piece is immediately shipped without questions.

I will continue to up-date my presentation to keep current with what is happening in my modular industrial technology lab. This PowerPoint (Microsoft®, 2000) has been a key instrument for enhancing my presentations. I am sure that it will continue to be beneficial to my future audiences as well.


Appendix A

List of Modules and Brief Descriptions
CADD
In the CADD Module, students use computer-aided drafting (CAD) software to explore the fundamentals of drafting. They use CADD software to create multiview drawings of a geometric solid. Students also use CAD software to complete a set of floor plans. The floor plans are based on standards for architectural drawings and the students implement 3-D software to create a computer “walk-through” of their floor plans.

Computer Graphics and Animation
In the Computer Graphics & Animation Module, students learn how the use of computers can enhance the products created by professional artists and animators. With the use of a computer and related software, the students produce their own cartoon and an animated sequence. They use a digital video movie camera to capture a picture and create an animated project. Students also explore video graphic design.

Creative Solutions
In the Creative Solutions Module, students are confronted with problems to solve. They use software and kits to assemble models to solve problems. Students also learn to develop problem-solving strategies as well as time management skills while increasing their self-confidence. Challenges are given to solve problems using models constructed from building sets. Students complete several different activities while using the computer to create problems that must be solved.

Digital Design
In the Digital Design Module, students are introduced to the principles of design that lead to effective visual communication. This Module also address the process involved when creating a layout. Students learn how correct usage of the various elements leaves the reader with a clear understanding of the intended message. The psychology used with design and layout is explained, including optical center, the “eye catcher,” and the eye movement through the material and off the piece.

Digital Manufacturing
In the Digital Manufacturing Module, students explore the manufacturing process and important inventions that have advanced these various processes. They learn the relationship of CAD software to manufacturing and use CAD to design a project that is later machined on the CNC machine. The Cartesian coordinate system and its effects on machine movement and digital automation are also presented.

Digital Video
In the Digital Video Module, students enter the world of digital editing and step into the creative role of editor. After being introduced to the preproduction phases of video, they learn the importance of computer power in the digital editing process. Students are exposed to elements that include good editing principles as well as special effects and manipulation of data, both audio as well as video.
Digital Transportation
In the Digital Transportation Module, students learn that transportation is the movement of people and goods. They see a brief history and a time line of transportation that shows walking all the way to space travel. This includes transportation on land and water and through air (atmosphere) and space. Students experience the latest technologies that impact transportation through the use of digital map reading, locating software, and a Global Positioning System (GPS).

Electricity
In the Electricity Module, students learn the principles of electricity and draw schematics of both parallel and series circuits. Students wire series and a parallel circuit and classify conductors and insulators. They use a volt-ohm meter as well as identify the magnetic fields important to the concept of electricity. Students also measure voltage, resistance, and current during the Module activities.

Energy, Power & Mechanics
When students complete the Energy, Power & Mechanics Module, they will have a basic understanding of energy sources, the principles of power technology, and the concept of mechanical advantage and machines. Students see how fluids can be used with other simple machines. Using Synergistic educational instruments, students learn the fundamentals of gears, fluid mechanics and three classes of levers. They also use a hot dog cooker and experience the concept of wind power.

Engineering Towers
Students utilize math, physics, and problem-solving skills in the Engineering Towers Module. They are given this challenge: build a tower that holds more weight than the towers built by their classmates. Designing, building, and testing a tower is the activity base in this Module. Using engineering skills and video segments, students learn the skills necessary to facilitate construction and evaluation of a tower.

Engines
In the Engines Module, students are introduced to the history, theory, and applications of engines. They learn shop and equipment safety, basic operating principles, parts, and tools – all through practical hands-on experience with a common four-stroke motor.

Flight Technology
In the Flight Technology Module, students learn the principles of flight. They use a computer flight simulator to experience piloting an aircraft. Each student evaluates the other and prepares a written critique of his or her partner’s flight. Students are introduced to navigation and they plot a course using angular measurement and mathematical computation.

Graphic Communications
In the Graphic Communications Module, students learn the fundamentals of drafting and communication of technical information. They also learn to use the related tools (drawing board, scale, triangles, and T square) needed to complete various drawings such
as orthographic projections. Design and measurement skills are also emphasized. The skills introduced in this Module will assist students throughout their lives.

**Light & Lasers**
In the *Light & Lasers* Module, students explore various aspects of light and lasers. Students also perform activities that provide examples of how technology can be used. They use geometric concepts to divide and reflect a laser beam into desired paths. Non-laser light is explored and manipulated through experiments that use lenses, prisms, filters, and intensity meters. The data from these experiments is analyzed and interpreted to provide a clearer picture of the nature of light.

**Package Design**
In the *Package Design* Module, students design and construct a package for a specified product. They explore spatial relationships as well as transformations and use rotations, reflections, and translations to create tessellations used as graphics for their packages. Students select a shape for their packages to conserve as much material and space as possible.

**Practical Skills**
In the *Practical Skills* Module, students learn to identify common tools and their uses. They will be introduced to the history of measuring systems, repair faulty systems, and follow directions to assemble prefabricated furniture. One important skill is to recognize situations when it would be best to call in a professional to help them solve the problem.

**Research & Design**
In the *Research & Design* Module, students design, manufacture, and race a model CO2-powered dragster car. Students design their car to meet certain specifications and limitations so that it qualifies as a legal car on race day. They learn the concepts and terms in the design process as well as gain an understanding of lift and drag on an object. After they finish their car, students test it in several ways and predict its performance.

**Robots**
In the *Robots* Module, students learn about the fascinating role that robots play in their lives. More and more, this technology is helping to improve the way we live and manufacture items. Students learn how to operate, program, and use robots in different environments. Initially, each student learns to manipulate the robot and program it to conduct repeatable tasks. Ultimately, they operate a robot located in a remote location away from direct view via a televised image of the work task.

**Rocketry & Space**
In the *Rocketry & Space* Module, students learn about the development of rocketry and the United States space program and its history. Learning the principles of rocket design, propulsion, and certain scientific principles that are fundamental to successful rocket flight are important concepts in this Module. Students construct and launch a model rocket as a means of applying the scientific concepts presented.
Simple Machines
In the Simple Machines Module, students explore how work, force, energy, and machines make moving objects easier through the use of the computer and hands-on activities. They use variables and equations to describe the principles of simple machines. Students use the information they learn about simple machines to design a compound machine that moves an object.
Appendix B

Copy of the Grant Proposals
SCOTT COUNTY REGIONAL AUTHORITY

GRANT PROPOSAL

FALL, 2000

WALCOTT MIDDLE SCHOOL
DAVENPORT COMMUNITY SCHOOL DISTRICT
Title: Walcott Middle School Modular Industrial Technology Lab

Statement of need:
Our present "shop" class has not been significantly altered or modernized in the past thirty years. Although making dustpans and clipboards are enjoyable for students, these activities simply do not provide the necessary connections to science and math in a real world and future relevant manner.

Our vision is to transform our "shop" classroom into a modern, modular, synergistic industrial technology lab. This would be a unique first for the entire Davenport Community School District and would serve as a prototype for all of the secondary schools in the Davenport Community School District. Through this modular-based, student-centered system, student teams would work cooperatively and collaboratively to explore an extensive, broad-based curriculum. The modular curriculum, research based, educationally sound and meeting national standards, is designed with a strong emphasis on math and science. The local one-cent sales tax option monies will provide the renovations, hardware and furniture for this project. This proposal acquire the necessary software, supplies, and equipment to provide a brain-compatible, concept-based delivery system that integrates technology into curriculum to enhance student learning while increasing student achievement.

Goal of the proposal:
Our goal is to give students learning opportunities that enable them to gain a deeper conceptual understanding of math and science and to explore and apply science and math in real life settings and context through technology. This would promote student success in future higher order classes and greater mastery of curricular concepts and academic principles by delivering a concentrated, multi-sensory, multi-model, hands-on learning approach. This proposal supports the Davenport School District's board goals and is an integral part of our Comprehensive School Improvement Plan. Our plan focuses on increasing student achievement in math and science.

Objectives of the proposal:
1. To provide a modular technology lab for seventh and eighth grader students.
2. To expose students to a divers array of modular activities that will help develop the skills, aptitudes and interest toward career-related fields.
3. To enhance student understanding and application in the following academic areas: math, science, reading and technology.
4. To provide inquiry-based investigations and explorations for student learning.
5. To increase "hands-on" learning experiences.
6. To allow students to work cooperatively and collaboratively in teams to solve problems.

Description of service/activities:
Our proposal for a modular technology lab would serve the entire western region of Scott County since Walcott Middle School services students from the communities of Blue Grass, Buffalo, Walcott, and the rural areas of western Davenport and Scott County. The population of Walcott Middle School is approximately 470 students in grades six through eight. The Industrial Arts department currently services approximately 350 students per year. Projected over a decade, approximately 3500 students will benefit from this industrial technology lab. The modular technology lab system, comprehensive and
available in a variety of subject matters, provides us with powerful curricular connections that could possibly allow other staff, students, and subject areas to also utilize the lab. Our proposal provides for community and family activities that would enable interested community members to learn and to utilize the lab. Consequently, not only would the entire student body and all future learners benefit for this lab, but also all of the communities whose children attend Walcott Middle School. Additionally, this modular technology lab may serve as a possible prototype for the entire Davenport district, impacting many thousands of students. Our mission statement challenges us to enhance and improve student learning by providing a quality education. Technology is one of the greatest change factors in our world today. This proposal would provide our learners and staff with skills that will enable them to meet the demands of the twenty-first century. The modular approach extends far beyond just the utilization of the computer, it allows for the computerized application of various concepts. The modular units are structured so students can work as teams. This enhances the interpersonal and communication skills that are essential in today’s world. The Walcott staff has studied brain-based learning and related components. This led to commitment to utilize the most effective teaching strategies that result in brain-based learning experiences that reflect that we learn best by doing.

Each modular unit cost between 5,000 and 6,000. We hope to purchase fifteen modules initially. Some of the exiting class projects will be incorporated into the modular units. Robotics, Lasers, Telecommunications, Digital Design, Computer Aided Drafting and Design, Rocketry, and Research and Design will be added to complete the transition to a Modular Technology Lab. Student progress is continually monitored and accessed through a central computer system. Immediate corrective feedback explains what they’ve done right or wrong and enables better comprehension of presented concepts by explaining the why. Pre and post-tests are used to assess student learning. Global, career, math, and science enrichment activities at the conclusion of the modular unit encourage students to apply concepts to the content.

Evaluation:
Student pre/post tests will be examined to measure growth/progress. A follow-up student/parent survey will be given to evaluate the effectiveness of this project. Results will be presented to the District Curriculum Cabinet and to the Board of Directors. Results will also be made available to the public. A Dedication/Open House will also be held. A formal presentation will be given explaining the grant and its results. A plaque will custom designed to recognize the Scott County Regional Authority’s contribution and hung in a place of prominence. Donation stickers will also be utilized in recognition. Extensive media coverage will procured.
December 14, 2000

Mr. Victor Quinn
Scott County Regional Authority
Post Office Box 474
Bettendorf, Iowa 52722

Dear Mr. Quinn,

The entire learning community of Walcott School would like to take this opportunity to extend our utmost thanks to you, Mr. Quinn, and to the Scott County Regional Board of Directors for the SCRA grant award that will enable our school to create an industrial technology lab for our students.

We truly appreciate the awesome opportunity that you have provided Walcott School. We eagerly await the completion of the lab and look forward to seeing you at the dedication ceremony.

Thank you again, Mr. Quinn, for your continued commitment to educational excellence.

Sincerely,

Nancy Jacobsen
Principal

Lynn Figg
Industrial Arts Teacher

Sherry Wilson
Facilitator
SCOTT COUNTY REGIONAL AUTHORITY

GRANT PROPOSAL

FALL, 2002

WALCOTT MIDDLE SCHOOL
DAVENPORT COMMUNITY SCHOOL DISTRICT
Title: Walcott Middle School Digital Technology Lab Expansion and Enrichment Program

Statement of need:
Our mission and commitment at Walcott Middle School challenges us to enhance and improve student learning by providing the highest standard of quality education to all students. Our need is to expand and enhance the modular curriculum that we already have in place so that we may provide a larger and more diverse array of learning opportunities that will allow our students to explore new technologies, careers, and curricular areas while increasing student academic achievement. Research has shown significant achievement increases in English, Math and Science after the implementation of this type of modular industrial technology program (Curriculum Research & Evaluation). Our modular lab has been in operation for nearly one year. After such a brief period of time, Walcott’s most recent Iowa Test of Basic Skills achievement data indicates significant increases in student performance in the areas of Reading Comprehension, Mathematics, and Science. We are dedicated to our mission of continuous school improvement and to increasing student academic achievement.

Our modern, modular, synergistic industrial technology lab is a unique first for the entire Davenport Community School District and serves as a prototype for all of the secondary school in our district. This educational delivery system is limitless in terms of the quality, the duration and the sustainability of service. Teams of students work together cooperatively and collaboratively to investigate an extensive, broad-based curriculum. The modular/digital curriculum is research based, educationally sound, meeting national standards and designed with a strong emphasis on reading, math, and science.

Our digital industrial technology lab serves a comprehensive group of students. The majority of our students are from the rural areas and small communities of western Scott County that lack accessibility to technology centers and facilities. Students with special needs, those considered to at-risk, and also the gifted population or our school are all learners in our modular lab. The industrial technology modules have allowed all of our students be successful without a modified curriculum. In order to better serve our learners, we would like to increase the number of modules in our lab to give students an even wider avenue for success and increased achievement. This proposal would enhance and enrich curricular choices and prevent the repeating of certain modules due to the lack of additional units. The collective support and generosity of the Scott County Regional Authority and the Davenport Community School District resulted in the creation of our unique modular industrial technology lab. The Scott County Regional Authority most generously showed their support by granting our funding request for the original modular industrial technology educational units. The local one-cent sales tax option monies provided the renovations, hardware and furniture for this technology lab. District monies, Allowable Growth funds, P.T.A. contributions and individual contributors will help this expansion project by purchasing additional industrial technology modular units.

Goal of proposal:
Our goal is to give students learning opportunities that enable them to gain a deeper conceptual understanding of math and science. Allowing students to explore and to apply science and math in real life settings and context through technology will promote success for all of our students by delivering a concentrated, multi-sensory, multi-model, hands-on learning approach. Our plan’s focus is on increasing student achievement in reading, math and science. This proposal is an integral part of our Comprehensive School Improvement Plan and strongly supports the Davenport School District’s learning goals.
Objective of the proposal:
1. To increase student achievement in the areas of reading, mathematics, and science.
2. To enhance students’ critical thinking skills.
3. To expose students in grade sixth, seventh, and eighth to a host of modular/digital technological learning activities that will help develop the skills, aptitudes and interest toward career-related fields.
4. To provide inquiry-based investigations and explorations allowing student teams to cooperatively and collaboratively work to solve problems and to create solutions.

Description of service/activities:
This proposal would enable Walcott School to serve students with state of the art, twenty-first century learning activities that are future relevant and result in the most effective brain-based learning experiences. With the purchase of four additional modular/digital curricular units and a color printer, we would be able to offer our students an enhanced and expanded selection of powerful curricular concepts and subject areas for study.

Our plan would include the purchase of four digitally delivered curriculum modules that would include: Energy, Power and Mechanics, Creative Solutions, CNC Lathe, Practical Skills and a color LaserJet network printer. These four modules would increase our students’ academic skills and abilities. The color printer would enhance the graphic communications workstations, allowing students to visually grasp the full realization of their final project.

This modular curriculum design continually monitors student progress and is accessed through a central computer system that has been provided by the Davenport Community School District. Immediate corrective feedback explains what the student has done correctly or incorrectly and enables better comprehension of presented concepts by explaining the why. Pre and post-tests are used to assess student learning. Global, career, math, and science enrichment activities at the conclusion of each modular unit encourage students to apply concepts to the content.

Estimate of people served and services delivered:
Our modular technology lab serves the entire western region of Scott County. Walcott School serves students from Blue Grass, Buffalo, Walcott and rural Scott County. Eighty percent of our students are based from rural areas and small neighboring communities. Fifteen percent qualify for free and reduced lunch. The population of Walcott Middle School is approximately 460 students in grades six through eight. Projected over a decade, approximately 4600 students will benefit from our modular industrial technology lab. This system, comprehensive and broad-based, presents the opportunity for students, staff, and other subject/grade areas to use the lab as well. Hands-on explorations for families and community members enable a significant number to utilize the lab. Generations of Walcott students, past, present and future, will all benefit from this proposal.

Evaluation:
Student progress will be monitored by analysis of all student achievement data. The publicity report will highlight all the achievements that have been attained as a result of this SCRA grant opportunity. A formal presentation and plaque will acknowledge the outstanding contributions of the Scott County Regional Authority. Donation stickers will be utilized in recognition. Extensive media coverage will be procured.
Davenport Community School District
Mission Statement

The mission of the Davenport Community School District is to enhance each student’s abilities by providing a quality education enriched by our diverse community.
An Overview of the Proposal Budget

The total funds needed for this project is $80,150.00.

The Davenport Community School District is funding $52,475.00, which is 66% of the total cost.

The Scott County Regional Authority funding that is being requested is $27,400.00, which is 34% of the total cost.
Detailed Budget Narrative

Proposal for Scott County Regional Authority Funding Request

Equipment Requested:

1. Creative Solutions Module
   A total modular unit that includes all software, all equipment, and installation. Total: $5,590.00

2. Energy, Power and Mechanics Module
   A total modular unit that includes all software, all equipment, and installation. Total: $5,440.00

3. Practical Skills Module
   A total modular unit that includes all software, all equipment, and installation. Total: $4,535.00

4. CNC Lathe Module
   A total modular unit that includes all software, all equipment, and installation. Total: $9,190.00

5. One H. P. Color LaserJet 4550N Printer
   A complete color toner set is included. Total: $2,735.00

Grand Total Requested from Scott County Regional Authority: $27,400.00
Brief Budget Narrative

The Davenport Community School District has shown its continuous support of the Walcott Middle School Modular Industrial Technology Lab by providing the facilities, hardware, furniture, and supplies for the lab. The local one-cent sales tax option monies, Allowable growth funds, and D.C.S.D. curriculum monies have all been utilized to equip the lab.

Personnel:

One full time D.C.S.D. Industrial Arts Teacher (Salary + Benefits) $40,000.00
Training in Modular Education 1,500.00

Total Amount for Personnel paid with D.C.S.D. funds: $41,500.00

Equipment:

Furniture $690.68
Communications Center $1,895.00
Rocketry and Space Modular Unit $2,552.00
H.P. LaserJet 4050N Printer $1,479.00
Modular Discovery Day Hands-on Learning Paks $4,288.32

Total Amount for Equipment paid with D.C.S.D. funds: $10,630.00
Total Amount for Equipment paid with P.T.A. funds: 275.00

Supplies:

Consumable module supplies $345.00

Total Amount for Supplies paid with D.C.S.D funds: $345.00
### FORM 1

**Scott County Regional Authority**  
Post Office Box 474  
Bettendorf, Iowa 52722  
319-344-2626

**March 15, 2002**  
Date Submitted

**Face Sheet**

1. **APPLICANT ORGANIZATION**  
Walcott Intermediate School

2. **MAILING ADDRESS**  
545 East James Street  
Walcott, IA 52773

3. **TELEPHONE**  
563-284-6253

4. **FEIN#**  
42-6001350

5. **CHIEF EXECUTIVE OFFICER/PHONE #**  
Dr. James Blanche, Superintendent  
(563) 336-5083

6. **DESCRIPTION OF PROJECT**  
Walcott Intermediate Digital Technology Lab Expansion and Enrichment Project

7. **CONTACT PERSON/PHONE #**  
Sherry Wilson - 563-284-6253

   *Grant award notification will be mailed to this person. Include address if different from mailing address above*

8. **FINANCIAL OFFICER/PHONE #**  
Marsha Tausen  
(563) 336-5062

9. **FUNDING CATEGORY** - Check appropriate space(s)
   - GOVERNMENT/CIVIC: CAPITAL  
   - EDUCATION: CAPITAL  
   - NOT-FOR-PROFIT: CAPITAL  
   - CONTINGENCY/EMERGENCY:

10. **AMOUNT OF FUNDING REQUESTED FROM SCRA**  
$527,400

11. **IS THIS A JOINT GRANT WITH RDA** (as defined in section 5 of SCRA Guidelines)  
YES  
NO  
X

12. **ORGANIZATION IS**:  
NON-PROFIT/501(c)(3)  
GOVERNMENT/CIVIC  
EDUCATION  
(Select 1)

13. **WHAT PERCENT OF SERVICES WILL BE FOR RESIDENTS OF SCOTT COUNTY?**  
100%

14. **IN WHAT STATE IS ORGANIZATION INCORPORATED?**  
Iowa  
HOW LONG?  
1858

   *Non-Profits must submit copy of current Iowa Certificate of Good Standing (not more than 2 years old)*

15. **HAVE YOU RECEIVED SCRA FUNDS IN PRIOR YEARS?**  
YES  
LAST YEAR  
2000

16. **AUTHORIZATIONS AND CERTIFICATIONS**: I hereby affirm that this application has been approved by the governing body. All data in this application is correct and true. The attached budget will provide sufficient resources to meet the goals and objectives identified in this application. If awarded, the organization will comply with SCRA guidelines.

---

**Revised Spring 2002**

### FORM 2

**Scott County Regional Authority**  
Post Office Box 474

**REVISED SPRING, 2002**

**PROJECT BUDGET**
**ORGANIZATION NAME**  
Walcott Intermediate School

**PROJECT / PROGRAM NAME**  
Walcott Intermediate Digital Technology Lab Expansion and Enrichment Project

<table>
<thead>
<tr>
<th>A</th>
<th>Total Funds Needed for this Project/Program</th>
<th>B</th>
<th>SCRA Funds Requested</th>
<th>C</th>
<th>Other Funds Applied for - (Including Joint Grants - See Pg 2 - Guidelines - 5-d)</th>
<th>D</th>
<th>Current Funds Available</th>
<th>E</th>
<th>Source &amp; amount of NON SCRA Funds for this project</th>
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* Complete this form for project or program for which you are applying. Include those expenses pertinent for this project/program only, not organization's complete budget. Attach detail sheets for expenses as needed.

1. SCRA does not normally fund personnel expenses, except for outside temporary contracted services. (Personnel expenses include salaries and benefits for part or full time employees or contract for services.)
2. Capital expenses include construction or remodeling costs projected to exceed $500 and having a useful life of more than one year.
3. Equipment expenses include machinery, tools, vehicles and appliances which are likely to remain in use for more than one year.
4. Supplies refers to items which are consumable.
5. Columns B,C,D should equal column A.
6. Column E should list organizations providing other funds & amount for this project. Use additional sheet if necessary.

Revised Spring 2002
November 14, 2002

Dear Ms. Wilson:

The Board of Directors of the Scott County Regional Authority is pleased to inform you that your organization was included in the final recommendations to the Board of Directors during this granting cycle for Walcott Intermediate - hardware & furniture for Modular Industrial Technology Lab.

The names of the grant recipients and amounts will be announced at a news conference on Tuesday, November 26, 2002, at 10:00 a.m. at Isle Center, Salon B (east end adjacent to the hotel). You or a representative of your organization are cordially invited to attend this news conference.

The Award Letter and Grant Agreement will be sent to your organization in the near future.

Thank you for participating in the grant process.

Sincerely,

The Board of Directors
Scott County Regional Authority
Appendix C

Printed Copy of Slide Show
Walcott Middle School

The Change From
Traditional Shop Classes
to
Industrial Arts
to
Modular Industrial Technology Labs

by Lynn Figg
Background Information
Lynn Figg

- Teaching for nineteen years in the Davenport Community School District
- All but two years have been in the area of industrial technology
- Developed curriculum for advancing technology
Curriculum Innovations

- Module Systems

- Modular Industrial Tecnology Lab

- What is a Modular System?
Module Definition

A student-directed module is delivered at self-sufficient workstations that accommodate everything students need to complete their activities

-Synergistic Systems, 2003

Unit of work in a course of instruction, which is virtually self-contained, e.g., a course in technology might consist of several independent topics. Modular courses are used where limited equipment or resources makes it desirable that several modules shall be taught at the same time on a rotational basis.

-Page & Thomas, 1977
My Opportunity Arises!!!

- Renovation to Walcott School
- Creating different space in the industrial technology lab
Search for the Right Modular System

- North Scott Junior High School
  - Eldridge, IA
- Washington Junior High School
  - Rock Island, IL
- Millard School District
  - Omaha, NE
North Scott Junior High School
Eldridge, Iowa

- Entire lab with modules
- Not student-friendly
  - Manual hard to understand
  - Modules designed more for upper grade levels
Washington Junior High School
Rock Island, Illinois

- Synergistic Systems
- Focus on 7th and 8th grade level
- 40-50 minute periods
- Tech support
Millard School District
Omaha, Nebraska

- Synergistic Systems
- 40 stations
How Our Modular System Became a Reality

- Local Option Sales Tax (LOST)
- Scott County Regional Authority
Why the Synergistic System?

- The system is student-centered
- Age appropriate yet adaptable
- The curriculum is module-based or topic based
- Workstations are self-sufficient
- Students work cooperatively in pairs
- Each module is based on the same framework or routine
The Law of 2 x 7

2 students per station
for 7 sessions (days)
Framework of Each Module

- Each module is set up the same
  - Assessment Time
  - Hands-On Activities
  - Enrichment Activities
Session 1

- Pretest
  - Individual test
  - Library time
- Hands-On Activities
  - Such as designing a CO$_2$ car
- Enrichment Activities
Sessions 2, 3, 4, & 5

- RCA Questions-3 different questions
  - Research
  - Challenge/Chart
  - Application of Mathematics
- Hands-on Activities
  - Solar hot dog cooking
  - Controlling remote robot
  - Milling project
- Enrichment Activities
Session 6

- Test Review
  - Game Format
  - Multiple Choice
  - Definitions

- Hands-On Activities
  - Designing a house
  - Using a lasers and mirrors

- Enrichment Activities
Session 7

- Post-test
- Hands-On Activities
  - Creating a virtual reality scene
- Enrichment Activities
Enrichment Activities

- Career Investigations
- Math/Science Enrichments
- Internet Research
- Bloop (game)
Learning Styles

- Visual
- Auditory

[Image of a person using a computer with headphones on]
Integrated Curriculum

- Technology
- Math
- Science
Modules

- **Communication**
  - Digital Design
  - Digital Video
  - Graphic Communications
  - CADD
  - Computer Graphics & Animation
  - Package Design
  - Creative Solutions

- **Manufacturing**
  - Engineering Towers
  - Simple Machines
  - Robots
  - Digital Manufacturing
  - Research & Design
  - Practical Skills

- **Transportation**
  - Flight Technology
  - Digital Transportation
  - Rocketry and Space

- **Power & Energy**
  - Lights & Lasers
  - Electricity
  - Engines
  - Energy, Power & Mechanics
Lab Manager

- Supplies worksheets
- Brings supplies to each workstation
- Tutors peers
  - (reader or absentee)
- Orientates new students
- Daily Log Keeper
Discovery Day

- Between each rotation
- Same problem for all
- Away from workstations
- Problem solving
Industrial Technology as We Knew It
Management Program
Questions and Exploration Time
Appendix D

CD of Presentation
Appendix E

Industrial Technology Education Association Standards
Listed below are the standards and descriptions as developed by the Industrial Technology Education Association (ITEA) that are addressed in the modular industrial technology lab at Walcott Middle School in Walcott, Iowa. (Pitsco, 2003)

**Standard 1: The Characteristics and Scope of Technology**
- Students develop an understanding of the characteristics and scope of technology.
- Students learn that new products and systems can be developed to solve problems or to help do things that could not be done without help of technology.
- Students learn that the development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.
- Students learn that technology is closely linked to creativity, which has resulted in innovation.
- Students learn that corporations can often create demand for a product by bringing it onto the market and advertising it.

**Standard 2: The Core Concepts**
- Students develop an understanding of the core concepts of technology.
- Students learn that technological systems include input, processes, output, and at times, feedback.
- Students learn that systems thinking involves considering how every part relates to others.
- Students learn that an open-loop system has no feedback path and requires human intervention, while a closed-loop system use feedback.
- Students learn that technological systems can be connected to one another.
- Students learn that requirements are the parameters placed on the development of a product or system.
- Students learn that trade-off is a decision process recognizing the need for careful compromises among competing factors.
- Students learn that different technologies involve different sets of processes.
- Students learn that maintenance is the process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.
- Students learn that controls are mechanisms or particular steps that people perform using information about the system that causes systems to change.

**Standard 3: The Relationships**
- Students develop an understanding of the relationships among technologies and the connections between technology and other fields of study.
- Students learn that technological systems often interact with one another.
- Students learn that a product, system, or environment developed for one setting may be applied to another setting.
- Students learn that knowledge gained from other fields of study has a direct effect on the development of technological products and systems.
Standard 4: The Cultural, Social, Economic, and Political Effects
- Students learn that the use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology’s development and use.
- Students learn that technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.
- Students learn that the development and use of technology poses ethical issues.
- Students learn that economic, political, and cultural issues are influenced by the development and use of technology.

Standard 5: The Effects of Technology on the Environment
- Students develop an understanding of the effects of technology on the environment.
- Students learn that the management of waste produced by technological systems is an important societal issue.

Standard 6: The Role of Society in the Development and Use of Technology
- Students develop an understanding of the role of society in the development and use of technology.
- Students learn that throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.
- Students learn that social and cultural priorities and values are reflected in technological devices.
- Students learn that meeting societal expectations is the driving force behind the acceptance and use of products and systems.

Standard 7: The Influence of Technology on History
- Students develop an understanding of the influence of technology on history.
- Students learn that many inventions and innovations have evolved by using slow and methodical processes of tests and refinements.
- Students learn that the specialization of function has been at the heart of many technological improvements.
- Students learn that the design and construction of structures for service and convenience have evolved from the development techniques for measurement, controlling systems, and the understanding of spatial relationship.
- Students learn that in the past, an invention or innovation was not usually developed with the knowledge of science.

Standard 8: Attributes of Design
- Students develop an understanding of the attributes of design.
- Students learn that design is a creative planning process that leads to useful products and systems.
- Students learn that there is no perfect design.
- Students learn that requirements for design are made up of criteria and constraints.
Standard 9: Engineering Design
- Students develop an understanding of engineering design.
- Students learn that design involves a set of steps, which can be performed in different sequences and repeated as needed.
- Students learn that brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.
- Students learn that modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.

Standard 10: Understanding Roles
- Students develop an understanding of the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
- Students learn that troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
- Students learn that invention is a process of turning ideas and imagination into devices and systems; innovation is the process of modifying an existing product or system to improve it.
- Students learn that some technological problems are best solved through experimentation.

Standard 11: Apply the Design Process
- Students develop the abilities to apply the design process.
- Students learn to apply a design process to solve problems in and beyond the laboratory-classroom.
- Students learn to specify criteria and constraints for the design.
- Students learn to make two-dimensional and three-dimensional representations of the designed solution.
- Students learn to test and evaluate the design in relation to pre-establish requirements, such as criteria and constraints, and refine as needed.
- Students learn to make a product or system and document the solution.

Standard 12: Use and Maintain Technological Products and Systems
- Students develop the abilities to use and maintain technological products and systems.
- Students use information provided in manuals, protocols, or by experienced people to see and understand how things work.
- Students use tools, materials, and machines safely to diagnose, adjust, and repair systems.
- Students use computers and calculators in various applications.
- Students operate and maintain systems in order to achieve a given purpose.

Standard 13: Assess the Impact of Products and Systems
- Students develop the abilities to assess the impact of products and systems.
- Students learn to design and use instruments to gather data.
- Students learn to use data collected to analyze and interpret trends in order to identify the positive and negative effects of a technology.
-Students identify trends and monitor potential consequences of technological development.
-Students interpret and evaluate the accuracy of the information obtained and determine if it is useful.

Standard 14: Medical Technologies
-Students develop and understanding of and are able to select and use medical technologies.
-Students learn that advances and innovations in medical technologies are used to improve healthcare.

Standard 15: Agricultural and Related Biotech
-Students develop an understanding of and are able to select and use agricultural and related biotechnologies.
-Students learn that technological advances in agriculture directly affect the time and number of people required to produce food for a large population.
-Students learn that a wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other useful products and in the care of animals.

Standard 16: Energy and Power Technologies
-Students develop an understanding of and are able to select and use energy and power technologies.
-Students learn that energy is the capacity of work.
-Students learn that energy can be used to do work, using many processes.
-Students learn that power is the rate at which energy is converted from one form to another or transferred from one place to another, or the rate at which work is done.
-Students learn that power systems are sued to drive and provide propulsion to other technological products and systems.
-Students learn that much of the energy used in our environment is not used efficiently.

Standard 17: Information and Communication Technologies
-Students develop an understanding of and are able to select and use information and communication technologies.
-Students learn that information and communication systems all information to be transferred from human to human, human to machine, and machine to human.
-Students learn that communication systems are made up of a source, encoder, transmitter, receiver, decoder, and destination.
-Students learn that the design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.
-Students learn that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.
Standard 18: Transportation Technologies
- Students develop an understanding of and are able to select and use transportation technologies.
- Students learn that transporting people and goods involves a combination of individuals and vehicles.
- Students learn that transportation vehicles are made up of subsystems, such as structural, propulsion, suspension, guidance, control, and support, that must function together for a system to work effectively.
- Students learn that governmental regulations often influence the design and operation of transportation systems.
- Students learn that processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluation, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.

Standard 19: Manufacturing Technologies
- Students develop an understanding of and are able to select and use manufacturing technologies.
- Students learn that manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning.
- Students learn that manufactured goods may be classified as durable and non-durable.
- Students learn that the manufacturing process includes the designing, development, making, and servicing of products and systems.
- Students learn that materials must first be located before they can be extracted from earth through such processes as harvesting, drilling, and mining.
- Students learn that marketing a product involves informing the public about it as well as assisting in selling and distributing it.

Standard 20: Construction Technologies
- Students develop an understanding of and are able to select and use construction technologies.
- Students learn that the selection of designs for structures based on factors such as building laws and codes, style, convenience, cost, climate and function.
- Students learn that structures rest on a foundation.
- Students learn that some structures are temporary, while others are permanent.
- Students learn that buildings generally contain a variety of subsystems.
Appendix F

District Photo/Video Permission Slip Sample
DATE:

MEMO TO:

FROM:

REGARDING PHOTO/VIDEO BY:

TO BE PUBLISHED OR BROADCAST (date & purpose):

Student Name _______________________ 

(Please print student name clearly.)

School Name _______________________ 

May be photographed/videotaped or a photo/video used of him/her as described above.

May not be photographed/videotaped or a photo/video used of him/her.

Parent Signature _______________________ 

Please return to the school staff person who provided this form as soon as possible & no later than ____________ .

Thank you for your prompt attention to this matter.