



**Technology Education
(Industrial Technology)
Program Evaluation**

2007-2008

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INTRODUCTION

In order to provide a context for program review, the committee thought it was important for the district and public to know the rationale and goals of the department prior to this evaluation. The rationale and goals below represent work completed by Industrial Technology (referred to as Technology Education later in this report) teachers prior to the 2001-2002 school year. A review of that information was important to our work due to changes in staff and should provide some insight to others as they review the current program evaluation report.

Rationale (2001-2002)

The overall objective of the Industrial Technology/Technology Education program is to develop the human potential of all students for responsible work, citizenship, and leisure roles in a technological society. To accomplish Industrial Technology/Technology Education designated educational roles, programs must systematically address each of its four primary missions, namely to:

1. Develop each person's ability to comprehend and apply the concepts of industrial and technological systems.
2. Develop each person's values and attitudes related to the appropriate use of industrial technology –its tools, machines, materials, processes, and products.
3. Develop each person's ability to use materials, technological processes, and hardware to achieve constructive work skills and enhance occupational opportunity.
4. Develop each person's integration of basic skills in all they do.

Review of General Program Goals (2001-2002)

- Develop an understanding of, and capability with, industrial technology—its processes, materials, equipment, and products.
- Develop an understanding of the practical application of mathematics, scientific and technological principles to industrial processes.
- Develop basic skills in the safe use of tools, machines, and processes used by industry and technology.
- Develop technological problem-solving skills and attitudes.
- Foster creativity in using technology for desirable purposes, by encouraging students to create from materials and with technological processes and hardware, new and different forms which have greater or alternative value.
- Contribute to meaningful occupational choice by developing an understanding of industrial and technological career opportunities and their requirements.
- Facilitate the discovery of individual talents, aptitudes, interests and potentials related to industry and technology through laboratory activity.
- Encourage cooperative attitudes, constructive work habits and other traits that will help secure and maintain employment.
- Engender pride in work done well.
- Develop consumer skills related to the appropriate production, consumption, and maintenance of technological goods and services.
- Reinforce general education's basic skills, and contribute to advanced education, by providing practical and motivating application of basic knowledge, attitudes and skills.

- Prepare for entrance into advanced secondary and post-secondary vocational/technical programs by promoting the development of a basic foundation of occupational skills and interests.
- Provide an alternative learning mode for those who learn better in settings other than the conventional classroom.
- Encourage the development of attitudes reinforcing the free enterprise system.
- Stimulate leadership behavior by student organization activity.

During the development of the TAMS (Technology Activity Modules designed by Missouri Technology Education at DESE) it is referenced that Technology Education is in a period of tremendous opportunity to develop a curriculum that integrates and makes connections to math, science, language arts, and other curricula. The district began to make the changes necessary to incorporate some of those changes by creating a standard middle school curriculum with which students could experience similar experiences and gain connections to the technological world through activities and challenges shared within the Technology Education classroom. Students began to see the connections Technology Education had to math, science, and language arts through well constructed activities.

REVIEW OF LITERATURE AND RESOURCES

Technology Education in Missouri

Technology Education is currently in a metamorphosis, from relying totally on the ability for teachers to provide students opportunities to create products from the use of metal, wood, and communication tools to teaching students how to problem solve to apply skills to a variety of circumstances. Literature from the ITEA (International Technology Education Association), the state department for Technology Education, STEM (Science Technology Engineering and Math), and other organizations and partnerships has moved Technology Education toward a pre-engineering curriculum.

Career Education in Missouri is supporting Exploring Career Clusters – Career Explorations Curriculum through MCCE (Missouri Center for Career Education). This curriculum is in the process of development in many areas, but has been completed in some of those that would pertain to Technology Education. The committee received a presentation from Ben Yates, one of the developers of the curriculum and an instructor in Technology Education at the University of Central Missouri. Many of the clusters that have been completed could apply to concepts taught in our Technology Education classes such as; Architecture & Construction, Arts, A/V Technology & Communications, Information Technology, Manufacturing, Science, Technology, Engineering & Math, and Transportation, Distribution & Logistics.

Module Instruction

Various vendors provide curriculum through module instruction. These are canned programs sometimes using computerized instruction to deliver the curriculum. In many of these programs teacher expertise is of little importance to the overall delivery of the curriculum, therefore districts have implemented the programs using a variety of certificated personnel. The expertise of the certificated personnel varies from district to district, but in many cases the lack of

extended knowledge limits the ability of the teacher to provide connections for the students to other related lessons, unless the canned curriculum makes that connection for them. A few of the current teachers in the department have taught in systems like this in other districts and found the curriculum restrictive and less responsive to the changing needs of students.

Another issue with these programs is the money required for the operation of the programs. Each module purchased by the district increases the overall cost of the program. Many districts purchase 5-10 different modules within the curriculum. The cost of these programs varies by vendor, and the number of modules purchased by the district. At this time the consensus of the department faculty is to not adopt one of these programs.

Project Lead The Way

In the past ten years there has been the development of Project Lead The Way. “Project Lead The Way is a national, not-for profit educational program that helps give middle and high school students the rigorous ground-level education they need to develop strong backgrounds in science and engineering.” PLTW’s curriculum makes math and science relevant for students. By engaging in hands-on, real-world projects, students understand how the skills they are learning in the classroom can be applied in everyday life. This approach is called activities-based learning, project-based learning, and problem-based learning or APPB-learning. Project Lead the Way gives students a glimpse of life as an engineer before making the commitment to majoring in the field at college.

All PLTW high school courses have several underlying content areas in common. As students progress through the sequence they will become proficient in:

- working as a contributing member of a team
- leading a team
- using appropriate written and/or visual mediums to communicate with a wide variety of audiences
- public speaking
- listening to the needs and ideas of others
- understanding the potential impact their ideas and products may have on society
- thinking
- problem solving
- managing time, resources and projects
- researching
- going beyond the classroom for answers
- data collection and analysis
- preparing for two-and four-year college programs

The program evaluation committee recommends that the department continue to explore this as part of their curriculum at the high school level. Currently there are 37 school districts in Missouri that participate in PLTW, some of which are new to the program and others that have now been involved for over five years. We are particularly interested in districts that have maintained some traditional technology education courses while progressing to the engineering heavy PLTW courses. Members of the committee will be visiting programs that have been

involved in the program for over three years and have maintained the traditional curriculum after the expansion to PLTW.

Engineering by Design (ITEA)

The Center to Advance the Teaching of Technology & Science (CATTS) was established in 1998 to strengthen professional development and advance technological literacy. CATTS initiatives are directed toward four goals: development of standards-based curricula; teacher enhancement; research concerning teaching and learning; and curriculum implementation and diffusion.

CATTS is the professional development arm of the International Technology Education Association (ITEA). ITEA is the largest professional educational association, principal voice, and information clearinghouse devoted to enhancing technology education through experiences in our schools (K-12). Its membership encompasses individuals and institutions throughout the world with primary membership in North America.

CATTS conducts research on teaching and learning through directed programs designed for quality teaching practices and assessment, development of resource materials, and support of teaching environments.

CATTS develops and disseminates educational materials through consortium work involving participants from states/provinces through local educational agencies or groups. Consortium participants receive quality products and services specific to their local and professional development needs.

The EbD™ Program (Engineering by Design) written by CATTS is a model to help schools develop themes in the STEM and IT Clusters (Industrial Technology) that are seeking to increase all students' achievement in technology, science, mathematics, and English through authentic learning. “The EBD™ program is built on constructivist models and creates awareness and competence over time as it builds on learned knowledge and skills--aligning closely with the Knowledge and Skills (Career Clusters) in both the STEM and IT Clusters.”

The EbD™ Program was designed to maintain integrity through two delivery scenarios.

- The Pathway program, where schools adopt the articulated sequence of courses in a STEM and/or an IT-themed academy.
- Modularizing the components and adapting the design themes to support the STEM, IT, or other academy models. In this scenario, as in many career-themed academy models, some modification is required to ensure themes are aligned with the Cluster Knowledge and Skills (Career Clusters).

Committee Summary of Literature/Resources

The committee believes that something needs to be done to strengthen the offering in the Technology Education Department. While it is easier to rule out the modular instruction provided by vendors, it was not so easy to determine the direction of writing our own curriculum versus using curriculum from other designers.

Teachers are comfortable with the curriculum provided by CATTs as it follows much of what the state department has been involved with for the past several years. The state is a member of the consortium which produces the curriculum and any district within the state can use the curriculum for free. It can be used in full or parts of it can be pulled to use within any course a district might want to teach. This flexibility is a plus and a minus. The plus side is that designing the curriculum and aligning to standards is much easier since most of that work has already been complete for the teachers, however on the negative side it leaves an opening for inconsistency in what is included in each course.

After the tours of PLTW schools in the fall of 2008 the committee will make a recommendation on whether a request will be made to the district for application for participation in PLTW and the required funding that would be necessary for the 2010-2011 school year implementation. The approval by the district would require teachers to participate in professional development during the summer of 2010.

The ITEA Strands in conjunction with the CATTs Standards allow for the department to address the changes that are occurring within Technology Education without throwing out the traditional pieces of the curriculum that serve all students as they move through secondary school. The focus on engineering and the use of problem solving will become a focus through the curriculum, no matter the course.

ACHIEVEMENT DATA (ENROLLMENT)

The overall enrollment for Technology Education in the Columbia Public Schools has been decreasing for the last several years. The committee members have speculated about the decline in enrollment, but have been unable to pinpoint one factor that is leading to the decrease.

Currently students in the middle schools all take an introductory class in Technology Education as part of the Encore rotation for all 6th grade students. This class meets daily for 90 minutes for 5 to 5 ½ weeks depending on the middle school in which the student is enrolled. Curriculum activities vary in the schools, but the concepts that students are exposed to are similar. In seventh grade students have the opportunity to choose Technology Education as part of their elective schedule and nearly 90% of the students choose that as one of their options during the year.

In the junior high program all Technology Education classes are electives. Students in eighth grade are still able to explore courses without regard to earning credit and have fewer required courses that they must take for high school graduation. The attempt has been made by the department to create curriculum and courses that provide for an overview of Technology Education at the eighth grade level, along with courses having specific focus. Scheduling at each of the junior highs has made sequencing of the curriculum difficult as each school mixes their classes for many of the elective offerings. Technology Education as with all the practical arts courses should provide semester options for students at the eighth grade level while providing a good overall exposure to all aspects of Technology Education. At the ninth grade level students should have the opportunity to begin a career cluster focus that builds on skills from previous

courses where possible or provides the foundational skills that could lead the student to a variety of career options.

The high school curriculum has provided options in a variety of areas for many years, but with little success in carving out a niche within the district. The exception to that would be the CASA Program. CASA, Columbia Aeronautics and Space Association, is a truly unique program housed on the campus of Hickman High School, Columbia, Missouri, USA. The largest student run space simulation in the nation, it uses an aerospace theme to provide a multidisciplinary learning experience which incorporates not only aerospace concepts, but also a knowledge of English, mathematics and science. The program utilizes themes in context curriculum which allows students to experience aerospace principles first hand, and develop life skills such as teamwork, responsibility, and leadership. Hickman has been teaching Aerospace for several years with the additional extra curricular component of CASA. Other courses at the high school level that have continued to maintain strong enrollment include Theatre Technology and Consumer Car Care. Many of the other options for students at the high school level have struggled to have enough enrollments to offer the class, with principals combining courses just to keep the enrollments in the department. This enabled the department to keep some sections that may not have otherwise been available, but in many instances did not provide the students with the curriculum for which they originally enrolled. Another struggle at the high school level is the fact that Rock Bridge High School does not offer any Technology Education courses which are taught by a certified Technology Education instructor. The department has not been able to offer classes at Rock Bridge High School since there has been no FTE designated if enrollments and classroom space warranted the hiring.

PERCEPTUAL DATA

Response to Student Survey Data (2006 Survey of Technology Education Students)

This survey was given to students currently enrolled in Technology Education courses.

Items 1-2, 4, 11, 13, 15, 18-20: Curriculum and Instruction

Seventy percent of the students “Agreed” or “Strongly Agreed” that the instruction and curriculum were challenging and motivated them to take other Technology Education classes.

- Helped develop problem-solving skills
- Apply learning to real world situations
- Developed teamwork and group work skills
- Teachers used a variety of teaching pedagogy

Item 6, 10: Resources/Facilities

The resources were adequate to continue their study in their class. We have to keep this in perspective since we don’t have any facilities currently in use at Rock Bridge High School, and we have declining enrollments at Hickman High School. Only currently enrolled students were surveyed during 2006-2007.

Items 7-8: Counseling for Course Selection

Students’ felt they received adequate or useful counseling; counselors 43% “Agree” or “Strongly Agree”, technology teachers 55% “Agree” or “Strongly Agree”. The most disturbing part of this

data is that 45% of technology teachers were graded at “Neutral to “Strongly Disagree” in their counseling for future courses in Technology Education.

Items 16-17, 19, 23: Course Sequencing

75.8% of the respondents “Agree” or “Strongly Agree” that the course they were currently taking was preparing them for other classes in Technology Education; 60.7% “Agree” or “Strongly Agree” that there were an adequate number of course choices; 66.9% “Agree” or “Strongly Agree” that the course prepares them for future education in the field or employment; and 58.3% were considering taking a class at the Columbia Area Career Center that related to an area studied in their class.

Response to Teacher Survey Data (2006 Survey of Technology Education Teachers)

This survey was given to teachers employed during the 2006-2007 school year. The findings in the teacher survey only represent 8 of 14 teachers or 57% of the teaching staff. The results below are based on the 8 teachers who responded to the survey.

- 87.5% Agree or Strongly Agree students’ placement is appropriate for the content.
- Teachers were split down the middle with regards to the class size being appropriate to the safety concerns that arise in classes.
- 75% Agree or Strongly Agree that adequate resources are provided to the class.
- No teachers disagree with the fact that professional development in current Technology Education curriculum would be helpful.
- 100% of the respondents felt confident in their use of alternative teaching strategies in their classroom.
- No teachers disagree with the fact that they had adequate time to teach the curriculum.
- Respondents felt there was inconsistency with regards to counselors assisting in the appropriate placement of students in elective classes.
- 50% of the respondents “Strongly Agree” that they receive support/encouragement from their administration; the other four (50%) respondents ranged from “Agree” to “Disagree” in regards to support/encouragement from their administration within the building
- 100% of teachers said they incorporated and documented math into the curriculum.
- Support for the grade level design in CPS was mostly favorable, however some teachers didn’t feel that it assisted in the vertical alignment of the curriculum
- All respondents felt they had an understanding of the curriculum in grades 6-12
- Most respondents felt they were aligned with the curriculum of the state
- All respondents felt that the students made the connections of what they taught to other curriculum in the school
- 75% of teachers were supportive of the state and national Technology Education curriculum
- 75% of teachers indicated they reference the state/national curriculum in their activities
- 37.8% “Agree” that they use the state curriculum; while 50% were “Neutral”.
- 75% of respondents indicated the coordinator and principal had access to the objectives

- 87.5% of respondents felt all Technology Education teachers needed to take part in the curriculum writing for all grade levels

Response to Parent Survey Data (Spring 2008 – All 7-11 parents)

The following responses are interpreted from the data received in the parent survey.

➤ **Introduction to the following concepts is important to parents.**

	Interested	Somewhat Interested	Not Interested
Engineering	48%	32.5%	13.5%
Home Improvement (Maintenance)	40.5%	38%	14.5%
Robotics	33.5%	34.5%	22%
Woodworking	23.5%	40.5%	24.5%
House Design (Architectural Drafting)	37%	38%	16.5%
Environmentally Green Technology	43%	32.5%	14.5%
Electronics	52%	28%	13%
Consumer Car Care	37%	35%	20%

Interest across the above curricular topics was very balanced. This is not too surprising as our program has always been one of investigating interests of students and parents seem to consider the classes a place for their children to develop these interests.

➤ **Satisfaction with the opportunities in your child’s school.**

	Very Satisfied	Somewhat Satisfied	Not Satisfied	Unfamiliar
Robotics	11%	17%	4.5%	60.5%
Aeronautics	11.5%	13.5%	5%	64%
Metal Working	11%	13.5%	5%	64%
Basic Car Care	8%	13%	7%	65%
Electronics	15.5%	16.5%	5%	57.5%
Construction	13.5%	13.5%	3%	62%

Based on the responses of the parents with regards to the understanding of opportunities their students have in Technology Education it seems that the department needs to provide more information to the public on what they do within their classes. Consistently over 50% of the parents were unfamiliar with what learning took place around the six areas mentioned above.

➤ **What careers interest your child? (Mark all that apply)**

	Area of Interest	Unfamiliar Area
Robotics	11.5%	51.5%
Telecommunications	24.5%	39.5%
Natural Resources & Environmental Service Systems	27%	38%
Power, Structural & Technical Systems	24%	41.5%

Production	10%	49%
Manufacturing Production	10%	49%
Process Development	9.5%	51%
Maintenance, Installation, & Repair	14%	46%
Quality Assurance	9%	48%
Health, Safety, & Environmental Assurance	25.5%	38.5%
Transportation Operations	9.5%	50%
Logistics, Planning & Management Services	16.5%	46.5%
Facility & Mobile Equipment Maintenance	5.5%	52%
Transportation Systems & Infrastructure Planning, Management and Regulation	11%	50%
Engineering & Technology	47.5%	30%
Design & Pre-Construction	31.5%	36%
Construction	17.5%	43%
Maintenance & Operations	12.5%	46.5%
Biotechnology Research & Development	25%	42%
Diagnostic Services	20.5%	41%

*Due to an error with the survey instrument data was not returned on Wood Technology.

➤ **Have you had a discussion with your child about their desired career path?**

Yes – 93.5%

No – 6%

➤ **The classroom experiences in Industrial Technology (Technology Education) courses show my son/daughter how to apply learning to real world situations.**

Over 58% of the respondents were at “Agree” or higher. The 20% of the respondents that responded “Unknown” is a concern.

➤ **Instructional activities/projects in Industrial Technology (Technology Education) courses helped my child learn life skills for living on his/her own.**

Over 51.5% of the respondents were at “Agree” or higher. The nearly 24% of the respondents that responded “Unknown” is a concern.

➤ **My child has enjoyed their Technology Education class.**

Over 63% of the respondents indicated “Agree” or higher that their child enjoyed the Technology Education class. Just over 16% indicated “Unknown”.

Response to Administrative Survey Data (Spring 2008)

Of the 38 principals and counselors working with students in grades 6-12, 18 responses were received.

Responses to questions 2 through 12.

The Technology Education courses in this building challenge students academically.	79% responded “Agree” or “Strongly Agree”
Technology Education courses in this building help to develop students’ problem solving skills.	90% responded “Agree” or “Strongly Agree”
Technology Education courses in this building are taught at the appropriate grade level.	94.5% responded “Agree” or “Strongly Agree”
The classroom experiences in Technology Education courses show students how to apply learning to real world situations.	94.5% responded “Agree” or “Strongly Agree”
Instructional activities in Technology Education courses help students learn more about technology in our society.	94.5% responded “Agree” or “Strongly Agree”
The resources available in the Technology classroom(s) are adequate to provide for further study in the program.	61% responded “Agree” or “Strongly Agree”; however there were 11% that “Strongly Disagree”, and over 22% that responded “Unknown.”
Students receive adequate counseling from counselors as to which courses in Technology Education would be most appropriate, and beneficial for them to enroll.	89% responded “Agree” or “Strongly Agree”
The daily objectives in Technology Education classes are clear to the students.	72% responded “Agree” or “Strongly Agree”; however almost 28% responded “Unknown”.
The Technology Education teacher uses a variety of teaching strategies to increase students learning.	67% responded “Agree”; however over 11% responded “Disagree”, and 22% responded “Unknown”.
There are an adequate number of Technology Education course available in this building.	66% responded “Agree”, while 33% responded “Disagree”
The activities in Technology Education classes in this building actively engage students.	94.5% responded “Agree” or “Strongly Agree”
The knowledge and skills students learn in Technology Education classes in this building prepare them for future education and/or employment.	100% responded “Agree” or “Strongly Agree”

Responses to items 13 through 18.

13. How do you see Technology Education helping students in your building?

- Technology will be a critical part of all students' lives after they finish school.
- Technology education builds confidence and competence with the ever changing pieces of technology.
- Students enjoy Technology classes in our building. The courses are high interest and project oriented and students are challenged and motivated to produce quality work. These classes give students a taste of a curriculum that both challenges them academically but isn't all sitting in a chair and listening.
- Students who enjoy working with their hands and learning without having to sit for 50 minutes really enjoy these courses. Students who are kinesthetic learners do well in these courses, even though they might not perform as well in core academic courses. This raises their self-efficacy and confidence and can help them stick with school, even though traditional academic courses are frustrating. When students come back to visit, they are excited to see their Tech teachers, suggesting that our teachers form strong relationships with their students.
- It gives kids another avenue to explore their academic interests.
- Helps kids that need to experience things hands on.
- I have seen tech students helping out at various times in the building fixing or building items that increase functionality of the building.

(Seven other responses thought Technology Education was teaching computers.)

14. What suggestions do you have for Technology Education classes to better support the students in your building?

- More updated facilities are desperately needed!!!
- Given them opportunities for more tech courses, particularly at Rock Bridge. The options simply dry up, unless they want to take Career Center courses.

(Eight additional comments referred to computer classes)

15. In what ways does Technology Education provide career education or career skills to students in your building?

- Students interested in building, architecture, engineering, computers, and even applied math can see how tech courses are relevant and interesting for them.
- It provides the first taste which gets them excited about looking for further opportunities as they enter the high school building. This would be better if our students had more access to Career Center classes.

(Many of following comments could be about Technology Education, but seem to be more about computer education. Two additional comments not included were directly related to the computer classes.)

- Career education is taught in the 6th grade Encore classrooms. Also, both middle school courses build skills that will be used for the remainder of students' lives.
- Not sure.
- The relationship between course work and world of work is pointed out. Columbia Chamber of Commerce Career Fair takes place during class.

- With a society that is growing and changing technologically at a very fast pace, it is important for our students to learn the skills necessary to be competitive in the work force. Our students learn valuable problem-solving skills that enable them to be a step ahead of the game when graduating and moving on to the career world. They are also introduced to many different careers in the technology field.
- Through advisory program, we use Missouri connections--a site approved by the state of Missouri.
- Students learn about careers in the classes.
- The more proficient they are with technology education, they have unlimited resources about career education and opportunities. We even provide a Careers class.
- The computer technology classes provide students with skills which will be beneficial toward exploring careers along with some skills that can be used as they pursue careers.
- Again, they will be able to compete with other students on a global level staying current in technology.
- In the computer concepts encore class counselors do a career unit.

16. In what ways do Technology Education classes in your building support the learning of core classes?

- Tech Ed incorporates reading, writing, problem solving, etc. for a purpose.
- These classes really support many curricular areas including math, science, reading and writing.
- Physics and Engineering dove tail into 1 course here. It also helps support the math curriculum, business (computers) through the use of website design.

(Eight other comments related more to computer instruction.)

17. Middle School Only: What role does Technology Education play in the education of students in the Intermediate configuration (6 – 8) since intermediate buildings will have considerable differences in facilities?

- (Excerpt) The courses should be offered to all 6th and 7th grade students through an exploratory block, followed by an elective in 8th grade.

(All other comments related to computer instruction.)

18. Junior and High School Only: How does the Columbia Area Career Center satisfy the needs of students in your building in acquiring general knowledge in trade and technology careers?

- The Career Center definitely satisfies the needs of students in acquiring general knowledge in trade and technology...if the student is able to get enrolled in the class. Many times classes are full and/or students aren't able to make the course work in their schedules. When students are in the classes, I definitely think they gain not only general knowledge, but also detailed knowledge that allows them to be way ahead of the game after graduation!
- Through presentations, need more classes at the 6-8 level.
- They assist tremendously. The teachers and counselors are a valuable resource!
- Skill Expo; Career Center Presentations; Some tours.

- The Career Center has very limited access for our students. The only course available to 9th graders in an Agriculture course, and now we can't even send interested students to the high school buildings for this course. If we can't support it here, then it's not offered. Our 8th graders have no opportunities for Career Center courses.
- We need more opportunities for our freshman to take Career Center classes. The issue is there is no room and they have to wait until their 10th, 11th, and/or 12th grade years. With an expansion of the Career Center, this would assist in more opportunity for our freshmen.
- At the junior high level not much since only one class is offered to our 9th graders which is Ag Science. We need to offer MORE classes to 9th graders.
- CACC does a great job.

19. Enrollments at the Columbia Area Career Center have risen while the enrollments in Technology Education courses at each high school have declined (in some cases completely eliminated). What do you see as the major reasons? (18 Responses)

	Agree	Disagree	Did not respond
Curriculum does not interest students	16.67%	61.11%	22.22%
Teachers are not student centered	11.11%	61.11%	27.78%
Facilities restrict offerings at the high schools	55.56%	16.67%	27.78%
Equipment restricts offerings at the high schools	61.11%	11.11%	27.78%
Requirements for high school graduation	66.67%	11.11%	22.22%
District FTE limits staffing	66.67%	11.11%	22.22%

20. Who or what determines the placement of the student in Technology Education classes?

	% Agree	% Disagree	% Unknown	% Did not respond
Student only	44.44%	22.22%	5.56%	27.78%
Counselors advice	66.67%	11.11%	5.56%	16.67%
Parent recommendation	72.22%	5.56%	5.56%	16.67%
Only class available	27.78%	38.89%	11.11%	22.22%
Not intending to attend college	0.00%	50.00%	11.11%	38.89%
Requirements for graduation	50.00%	11.11%	5.56%	33.33%

PROGRAM STRENGTHS AND CHALLENGES

Commentary on the strengths and weaknesses of the program according to the teachers during open discussion identified the following items:

Strengths

- Hands-on learning; students are able to produce a product that enhances their learning
- Students are engaged in the process of creating a product

- Curriculum provides cross-curricular support for math and science
- Real world application of problems and their possible solutions
- Safety training for life
- Practical knowledge used in daily lives
- Provide a place for non-traditional students to experience success
- Build self confidence of students
- Break traditional gender boundaries
- Teach problem solving and the process of design

Challenges

- Program is expensive to maintain
- Resist conformity – lack of consistency/uniformity in curriculum
- Only one of everything/everybody
- Time – not enough
- Limited resources and facilities
- Breadth vs. Depth
- Fear of change – lack of knowledge in other areas of curriculum

PROGRAM PHILOSOPHY AND RATIONALE (2007-2008)

Technology literacy is increasingly important in our technology-driven society. The Technology Education Program is designed to educate all students in the following five strands: Nature of Technology; Technology and Society; Design; Abilities for a Technological World; and The Design World. Knowledge in all of these strands serves as a vehicle to develop and enhance understandings, skills, and attitudes that are applied in real life situations, regardless of career aspirations.

RECOMMENDATIONS

Curriculum Recommendation

The curriculum standards that the Technology Education department should align with in the future are the Standards for Technological Literacy, created by International Technology Education Association (ITEA). Although much of what we have been doing is connected to the standards the department has never formally aligned their work to these standards. The curriculum materials created by the State of Missouri and provided to teachers have been aligned to these standards.

In the past, in the absence of district-wide coordination in Technology Education, each building began to create curriculum for use in their building without regard to how that might affect the sequencing of curriculum or the offerings in other buildings. Over the years the curriculum of the department has wandered in a variety of directions with each grade level, building, and teacher doing their own thing. What was once a curriculum that was aligned across the district slowly became a curriculum that was very site based, and in some cases teacher based.

Although Technology Education had a part-time coordinator there was never time for him to work with the staff in aligning the curriculum across the district. The district now employs a full time coordinator for Practical Arts who will lead this work.

The department will be working on the reorganization of the curriculum to meet students' needs at the new intermediate level and high school level. This requires a new mindset for the teachers in order for this to happen. Each level of the current curriculum has worked independent of the others, but as we rewrite the curriculum there will be an effort to articulate what we do at each grade level to the next or provide students with foundational skills to enter a career path that works with the high school and the Columbia Area Career Center. The focus of the curriculum writing will revolve around the incorporation of engineering thinking within each course, as that is the focus of the research reviewed. Several of the resources for Technology Education provide information to incorporating engineering concepts into the curriculum and those concepts are supported by our survey data.

The department has always had the ability to meet the MSIP requirements, however the curriculum taught across the district might not have been the same. The evaluation team recognizes that this must change and will be working to align the curriculum both horizontally and vertically during the curriculum writing process. Although the pieces required for MSIP are in existence with each course, the continuity within the department can be improved. The department can do a better job of consistently implementing the same curriculum across the district at each of our three grade level configurations.

After reviewing school districts similar to Columbia in Fall 2008 the committee will make a recommendation regarding the adoption of the PLTW curriculum.

Differentiation

Instructors in the Technology Education Department use a variety of appropriate instructional methods. Teachers demonstrate and model appropriate techniques for students, provide practice time during which they are assessed, additional instruction might follow, and then students work on their project. Periodic check points allow for the student and teacher to make adjustments to the pace of the learning. In classes like our Physics and Engineering students participate in more experimental design and evaluation of their own learning. All courses should begin to develop this idea of problem solving and experimentation in order for students to become critical thinkers. The grade level of the courses dictates much of the pedagogy at this point within the department.

All practical arts course have a significant number of students with learning disabilities, along with students that have experienced academic difficulties. Teachers are constantly adapting assignments to meet the needs of these students, attempting to help each of them extend themselves as far as possible. Safety issues restrict some of the work students are able to do on their own as they progress through the assignments and projects. When working with tools and power machinery it sometimes is very difficult to differentiate the learning experiences to meet the measurable learner objectives at the same level.

The other end of the spectrum also exists to some extent in our courses. Some students continue work on projects that extends their learning above and beyond the curriculum of the course. Students are also provided opportunities to choose projects that are of greater difficulty in order to challenge their ability. This is an area that the department needs to work on during their curriculum writing; building in extension activities that blend with the instruction taking place and extending the development of those students able to continue with less instructor assistance.

Materials and Facilities

As indicated in the findings there are concerns about the facilities in the buildings or the access to classes for some students in the district. At the high school level the access to the Technology Education Program is limited to students at Hickman High School, as Rock Bridge High School discontinued offering courses several years ago with the retirement of the teacher that was employed at the time. While proximity does allow Rock Bridge High School students convenient access to Career Center courses, the Career Center does not offer the Technology Education courses that are available to students at other schools in our district. At the junior high level, the district has constructed new spaces for Technology Education at Jefferson Junior and Oakland Junior Highs. This need remains at West Junior High School. The middle school level provides the most consistent facilities in all three buildings. Curriculum in the middle level buildings are the most closely aligned due to similar facilities and the fact that the middle school program has come with more direction in regards to their purpose. However, as the change to the 6-8 configuration moves forward with all middle and junior high buildings becoming intermediate level buildings the differences in facilities will be a concern. All Technology Education classrooms have storage issues.

The first change to facilities needs to occur at Rock Bridge High School where the current room (108) has been divided in half and is currently used for FACS classes and some study hall classes. This facility is equipped for Technology Education classes, with an air handling system and overhead electricity for workbenches. This facility could be used for a variety of classes in the Technology Education Department and could possibly still be shared with FACS for classes like Interior Design. It may take some time to build enrollments since the classes have not existed for several years. Teachers in a building are the best sellers of a program and without a Technology Education teacher at Rock Bridge High School recruitment or proper placement of students is challenging. This will be particularly important when 9th graders attend all 3 high schools in 9-12 buildings.

Technology Plan

Equipment is a major part of the Technology Education Department, whether it is the traditional machinery, electronics, robotics, and computers in the classroom or more 21st Century equipment to allow computerized manufacturing, engineering equipment, more advanced robotics, and environmentally green experimentation equipment. Preparing the students for the challenges they will encounter in their lifetime will require the department to purchase new equipment in all of our buildings. If we are to continue the Physics and Engineering link at the 9th grade level at each of our junior highs or high schools (when they are four year) there needs to be access to a computer classroom or a mobile lab on a regular basis.

PROFESSIONAL DEVELOPMENT PLAN

Areas of Professional Development:

- Refresher on woodworking skills
- Robotics with Legos and other robotic systems
- Physics and Engineering curriculum
- Assessment for Learning in Technology Education
- Engineering in the Technology Education classroom

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