DELIVERING QUALITY TECHNOLOGY EDUCATION THROUGH TEACHER-WRITTEN OR VENDOR-WRITTEN TECHNOLOGY EDUCATION MODULES

By

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ABSTRACT

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Vendors and instructors are creating technology modular education units at a rapid rate. Many of the middle school technology education programs across the country are implementing modular programs to deliver their curriculum. Hopkins Middle School has incorporated both vendor-written and teacher-written technology education modules and wonder if there is a difference.

This study researched vendor-written and instructor-written modular technology education curriculum to determine which program is better at meeting widely

excepted criteria for a quality technology education program. The study looked at three different module topics. A teacher-written technology education module and two vendors-written technology education modules were compared for each of the module topics. All modules were worked through to see which benchmarks from the *Standards for Technological literacy: Content for the Study of Technology* were being addressed. The four subjects were then examined individually to see if they met the nine questions raised by Wright (1997) "Presented as a way to evaluate the effectiveness of modules, design-based instruction, or other approaches to technology education" (Wright, 1997, P.6).

The study found that teacher-written technology education modules were in fact better then vendor-written modules, although modular technology education was found not to meet the characteristics of a quality technology education program on its own

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Chapter 1

Introduction

Technology education is in tremendous transition attempting to adapt to and reflect a fast moving, highly sophisticated, technological society (Starkweather, 1992, p.27). Starkweather describes five of these changes. First, teachers are focusing more on a technological base than on an industrial base. Second, subjects that covered specific subject orientation (woods, metals, & drafting), are being replaced with courses focusing on concepts, processes & systems (construction technology, transportation technology, communication technology, manufacturing technology, and bio-related technology). Third, education orientation is being replaced with general education orientation in hopes of creating a closer relationship with math and science. Fourth, the name of the subject area has changed from industrial arts to technology education. Fifth, thing/job analysis is being replaced with human need analysis to focus more on a person's adaptability to solve problems and use technology, other than performing a single task (Starkweather, 1992, p.25-27). These changes adjusted the direction of technology education, identified new teaching methods, created guidelines, and set goals for technology education (Starkweather, 1992, p.27).

Some of the different ways of teaching technology education are: practical science approach (e.g. principles of technology), career emphasis, constructive methodology, computer emphasis, problem-solving approach, engineering systems approach, extra-curricular activities, math/science/technology integration, modular approach, socio-cultural approach, students-centered approach, and tech prep (Foster, Wright. 1996, p.18). One of these teaching methods that came about during this change is modular technology education (MTE). MTE is defined by Hearlihy & CO as a teaching system that divides the classroom into multiple learning stations, each manned by a team of two students (Hearlihy & CO., 1995, p.2). This change has received both praise and criticism.

On the positive side, modular technology education gives students an active role in their learning (Hearlihy & Company, 1995, p.2). Modular instruction: teaches a number of important concepts in a short period of time, introduces several career choices in the working world, and encouraging cooperative learning, self-discipline with independent (self-directed) learning and illustrating applications of mathematics, science, social studies, and language arts through various activities (ITEA, professional series, 2000, p.25). Modular technology education also offers the students a larger scope of technology and gives them a hands-on approach to learning.

On the negative side, modular technology education is a vendor-driven approach to technology education and leaves the development of curriculum to product companies (Petrina, 1993, p.73). It is also criticized for only scratching the surface of technology, which is said to result in intellectual fragmentation and make difficult the coherent and progressive development of student skills (Jenkins, Walker. 1994, p.19). Another drawback of modular technology education is that it prevents students from collaborating as a class at the end of an activity, which allow the students to express what they have learned from each other.

While there are many positive and negative things being said about modular technology education, they all tend to focus on individual parts of modular teaching and not the whole. There is a need for examining modular technology education as a curriculum to determine if the curriculum meets standards put forth in *Standards for Technological literacy: Content for the Study of Technology* to support it as a quality technology education course. When looking at modular technology education as a curriculum, it must be determined if there is a difference in quality between the different vendors and instructor curriculums to insure that a quality curriculum is selected for consideration.

Statement of the Problem

Does modular curriculum, as described by a self-contained instructional system defined by programmed learning theory, technological devices and equipment, (Petrina, 1993, p.72), written by a teacher or vendor meet the standards for technological literacy? The standards are derived from to the compendium of major topics for technological content standards, from *Standards for Technological literacy: Content for the Study of Technology*.

Purpose of the study

The goal of this study is to determine if vendor written or instructor written curriculum presently being used in technology education in the form of modular education is better at meeting widely excepted criteria for a quality technology education program. With this information, the Hopkins public schools Independent School District No.270 will be able to use this information to update present modular labs and develop a new lab in the district to aid in the district's goal of creating technologically literate students.

List of Questions

(1) Are vendor-made modules superior to teacher- made modules in addressing the national standards for technological literacy?

(2) What are the main differences in the curriculum supplied by vendors and curriculum created by teachers?

(3) Can modular technology education be classified a quality technology education curriculum?

Limitations

Because this study is exclusive to modular laboratories in the Hopkins School District, findings are not intended to be generalized.

Definitions of terms

Technology Education: the study of technology and its effect on individuals, society, and civilization (Savage, Sterry, 1990, p.20).

Modular approach to technology education: A self-contained instructional system defined by programmed learning theory, technological devices, and equipment (Petrina, 1993, p.72).

Individualized Instruction: Each student facilitates his or her own learning by some method without direct instructions from the instructor.

Chapter 2

REVIEW OF LITERATURE

This review of literature illuminates a vast amount of information on modular technology education and quality technology education. This review will give a broad overview of these two topics which will provide a foundation for this study.

Modular technology education articles

Several articles have been written about educators' opinions of modular technology education. Pullias (1997) states that modular labs offer a limited experience with most of their effort going towards organized structure, the management system, and assessment. Modular labs are lower level and students cannot gain true understanding from applying concepts to real world problem solutions. Pullias opines the next level should provide students with; experiences in critical thinking and true problem solving, the ability to not only learn about technology but to demonstrate an understanding of technology, an experience that connects all parts of technology to make a whole.

Daugherty and Foster (1996) asked four educators to respond to five statements concerning modular instruction in technology education. The statements address the following issues of modular technology education. (1)

Modules are exciting, efficient, and effective student centered means of introducing students to variety of broad technological concepts. (2) The modular approach holds great promise for improving the public image of technology education. It is responsible for the resurgence of outside interest in the field it encourages the integration of school subjects with technology. (3) Modular technology education is an unfortunate return to outdated practices emphasizing equipment or concepts. (4) Corporations have spearheaded module development and implementation. (5) Modules are a positive experience for the learner placing the responsibility for learning on shoulders of the student. The educator’s responses varied.

Gene Gloeckner from Colorado State University responded in favor of modular technology education. He opines that “whether modules are developed by vendors or teachers, they allow for more exposure to tools, materials, and processes than previous laboratory designs”(p.27). He also states that modules are what you make of them and that teachers need to alter them to fit the needs of their curriculum as well as their students.

Pat Hutchinson from Trenton State College (NJ) states “I do not see modules as particularly effective in providing students with the transferable tools they need to solve problems in the larger world” (p.28). She also states that modules promote self-contained instruction preventing integration of subject matter from happening. She opines that there are not enough modules with value to create a meaningful program.

Mike Jensen from Paonia High School (CO) states "I find that the use of modular instruction, as a method of instruction, to be a prime unifying force in tying all aspects of technology together" (p.29). He goes on to offer that with the use of the modular approach to instruction, modules can quickly be changed to meet the needs of other subjects and students who desire deeper insight into an area of technology.

Steve Petrina from the University of British Columbia states "if the end result of technology education is to impress students and administrators with a glance at someone's narrow idea of the future, or train students in the use of certain narrow technologies, then modules may be effective. But, if the end is technological sensibility and political astuteness for students as citizens, then modules are irrelevant"(p. 28). He also states that modules are not designed to show real world problems and are in fact educationally restraining.

As you can see, the panelists varied the on their opinions of modular education, raising the point that is time to the profession to reach a consensus on the role of modular instruction in the area of technology education.

Stephen Petrina (1993) presents three points as deficiencies of modular technology education. The first point focuses on technology educators' continued desire to focus on equipment rather than curriculum. The second point is that the teaching methods and theory modular technology labs use are ties to "dated learning theories, systems thinking, and their concomitant systems metaphors which reinforce ground-to-be covered concepts of education"(p.74). This second point questions vendors' claims that modular technology education is the teaching system of the 21st century. Third, Petrina discusses the transfer of control and authority from technology teachers to product companies. This transfer of authority undermines a teacher's ability to create their own curriculum and places the focus of curriculum on company profits.

Gloeckner and Adamsom (1996) examined modular technology education from both sides and determine that modular technology education is a good tool to incorporate into the technology curriculum and should be used along with other teaching styles. Two points that they stress are 1) Include modules as an instruction component of a larger goal, 2) utilize equipment in as many ways as possible throughout the curriculum. They view vendor-developed curriculum as a benefit, but view a teacher-developed module as the most effective. They conclude with, "using modules in conjunction with other forms of teaching will only add to our power and ability to help our students soar into the future"(P.21).

Modular technology education research

When examining past research in the area of modular technology education, most tend to focus on to what extent our module technology education labs being used and educators' perspectives of modular technology education. There is little or a lack of studies on modular technology education that examines its content to determine if it is a quality curriculum, or a study that compare educator-written modular technology education curriculum with vendor written modular technology education curriculum. Two studies compared modular technology education to traditional technology education. The first study G. Rogers (1999) concluded that when looking at three types of instruction, Modular industrial education, traditional laboratory, and industrial technology education, industrial technology education produced the greatest overall achievement gain. Students in the modular industrial education and traditional laboratory showed no achievement gains between pre-tests and post-tests. They showed a drop with the traditional pre-test mean of 20.88 and a post-test mean of 20.01 and the modular pre-test mean of 22.29 and a post-test mean of 21.49. The contemporary lab however showed an 11.5% gain with a pre-test mean of 25.11 and a post-test mean of 28.00.

In a second study that compared modular technology education to traditional lecture and demonstration, Silkwood (2000) looked at final test scores from two eighth grade classes. One class having been taught with traditional lecture and the other having been taught buy a technology education modular on bridge construction. It was concluded that there were no significant advantages between the instructional methods.

Other studies focused on teacher perception of technology education and to what extent modular technology education was being used. Foster and Wright (1996) concluded that three of the six groups (state supervisors, teacher excellence award winners, and technology education collegiate association officers) listed modular technology education as its first choice for the most appropriate approach to teaching technology education at the middle school level. Chairs of National Council of Accreditation of Teacher Education approved technology education programs and American Vocational Associations Technology Education Division board members listed it as their second choice.

While the International Technology Education Association board members listed it as their fifth choice with student-centered as their first choice.

Sanders (2001) examined current programs and practices in technology education. With respect to modular technology education, the study found that when asked to describe their facilities teachers responded that 35.9% have unit labs, 29.7% had general labs, 17.9% had systems labs, and 16.4% had modular labs. But 48.5% responded that they had some type of vendor-created modular workstation and 72.5% had teacher-created modular workstations showing that most programs utilized modules in their teaching. The group was asked what teaching method they used most and design/build solution was most commonly used (36.7%) with teacher plans at 27.9% and vendor/modular at 19%, teacher/modular at 16.4%. Brusic and LaPorte (2000) examined the extent in which modular technology education is used and how teachers that are using modules felt about their programs. The study found that 50.3% were teaching in a conventional lab, 24.7% were teaching in a modular lab, and 24.9% were teaching in a combination of the two. Most of the modular technology education classrooms were in the middle school 80.5%. Vendor-created modular technology education labs made up most the labs with 86.5% and 13.5% being developed by the teacher. The teachers teaching in these programs found the principal advantage of modular technology education is that it promotes universal skills and is more of representative of current technologies. The principal advantage of modular technology education to students is that it has a wider range of appeal and applies more universal skills.

As you can see from the data from these five studies, modular technology education does not show significant gains or drops in students' learning when compared to other technology education curriculums. The studies also illustrates that there is an increase in modular technology education labs implementation with most of them being vendor written.

Quality technology education

Curricular design in technology education has responded to the realities of our culture, at least in theory. Full application has yet to be realized in most parts of the country. Theoretically, the concept is sound and achievable. By design, it interprets our technical means, its evolution, utilization and significance. It addresses the primary technical activities of the human (construction, communication, manufacturing, energy/power and transportation). It is designed to help students understand the resources used for technical achievement (input), how they are utilized (process), and the significance (output) (Lauda, 1988, P. 14). To better meet the needs of our culture, individuals and agencies all across the country have started to define the characteristics of a quality technology education lab.

A Framework for Technology Education Curricula which Emphasizes Intellectual Processes list quality technology education as;

> (1) Students should acquire a repertoire of cognitive and metacognitive skills and strategies that can be used when engaged in technological activity such as problem solving, decision making, and inquiry. (2) Students should gain an awareness of the nature of thinking and their mental capability to control attitudes, dispositions, and development. (3) Students should be able to use thinking skills and strategies with increasing independence and responsibility. (4) Students should attain high levels of knowledge in a variety of subject areas including technology, mathematics, science, social studies, and composition. (5) Students should be provided with activities that closely represent real world situations and contexts. (Johnson, 1992, p. 33 - 34)

The department of education for Virginia lists these goals of what a quality technology education program will teach a student.

(1) Students will comprehend the dynamics of technology, including its development, impact, and potential. (2) Students will employ the technological processes of problem solving, creating, and designing. (3) Students will analyze the behavior of technological systems and subsystems, including the tools, materials, processes, energy, information, and people involved in systems. (4) Students will apply scientific principles, engineering concepts, and technological systems in the processes of technology. (5) Students will discover and develop personal interests and abilities related to a wide variety of technology-oriented courses (Dugger, 1992, p.7).

Technology Competence: Learner Goals for All Minnesotans states that a quality Tech. Ed. program should give students the following technological competence:

World view attributes of technology Competence. World view attributes relate to the general outlook and attitude of the students with respect to technology. (1) Systems View of Technology. He or she recognizes the interdependence of science and technology and knows that technology is broad, affecting all human endeavor. (2) Lifelong Learns about Technology. The Graduate has an ongoing interest in new developments in technology and undertakes new learning to adapt to and foster change. (3) Global Perspective of Technology. He or she recognizes that the development and use of technology in one part of the world can have dramatic impacts on others. (4) Historical Perspective on Technology. The graduate is able to recount major developments in technology and assess their cultural, social, economic, and ecological impacts.

Practice Attributes of Technology Competence. The practices of technology reflect the knowledge, skills, attitudes, and values required to participate constructively in economic, political, social, and ecological systems as they relate to technology. (5) Acquiring and Managing Information about Technology. He or she is able to identify and access sources as well as to codify, store, and subsequently recall information for use. (6) Communicating and Technology. He or she formulates ideas and organizes information to elaborate, illustrate, and explain. (7) Ethically Using Technology. He or she uses technology in an ethical manner with respect to social conventions and laws. (8) Relating Technology to the Arts, Humanities and Social Sciences. This involves attention to technology in the arts and humanities as well as in the social sciences. (9) Relating Technology to

Mathematics and Science. He or she applies mathematics and basic scientific principles in defining, analyzing, and solving technological problems. (10) Developing, Selecting, and Using Technology. The graduate selects technology appropriate to the problems and circumstances he or she faces in a variety of contexts and settings. (11) Creating Solutions through Technology. He or she applies the technological process to the solution of a variety of problems in daily life. (12) Critically Evaluating Technology. He or she assesses the risks and benefits of a variety of technological applications and systems. (13) Relating the Common Good to Technology. He or she understands the need for public policy regarding the use of technology (Mercer, Zilbert. 1992, p. 7 - 11).

When we look at technology education and its objectives when developing a quality curriculum does any one teaching method meet those objectives? I look to Gloeckner and Adamson who point out modules should be used as a part of a technology education program’s curriculum. I can agree with many of the points made about technology education modules in this review; whether they are negative or positive, but when I put them together as a whole, I am in favor of technology education modules knowing that they should be a part of the curriculum and not the entire course work.

CHAPTER 3

Methodology

The purpose of this study is to determine if vendor-written or instructor-written curriculum presently being used in technology education in the form of modular education are better at meeting widely excepted criteria for a quality technology education program. The following information describes how the information will be gathered, analyzed, and presented.

Documents

The focus for this study will be on nine modular technology education units covering the topics; video, CNC, and Robotics. The modules will come from vendors A, B, C and instructors. Two modules from each vendor and three from the instructors will be examined.

Instrumentation

The instrument used in this study will be *Standards for Technological literacy: Content for the Study of Technology*. The Standards for Technological Literacy were developed to present a vision of what students should know and be able to do in order to be technologically literate. Standards for Technological Literacy was created under the aegis of the International Technology Education Association and its Technology for All Americans Project; with hundreds of educators and professionals participating in its development and revision (International Technology Education Association, 2000, P vii.). The second part of the instrument is a series of nine questions for the article, Modules: Friend or Foe by Thomas Wright.

Wright (1997) states that modules, along with other ways of presenting curriculum, should be evaluated on their ability to provide appropriate opportunities for students to develop technological proficiencies. We should subject all technology education curriculum, regardless of its structure, to the same scrutiny. Less emotion and more critical analysis of the technology education curriculum and methods are needed. With that in mind, Wright developed the nine questions used from Technology for All Americans (1996), Teaching Technology (Wright, Lauda, Israel, 1995), and Technology Education-a Position Statement (Wright and Lauda, 1993)(Wright, 1997, p 6.). The nine questions are;

> (1) Does the program communicate a clear educational goal? (2) Does the program show evidence of a clear definition of technology? (3) Does the program present a historical perspective of technology? (4) Does the program present the processes or actions of technology? (5) Does the program present technology through authentic contexts? (6) Does the program

> present technology as an activity where multiple answers are possible? (7) Does the program encourage copperative attitudes and teamwork? (8) Does the program provide opportunities for open-ended activities? (9) Does the program encourage resourefulness and initiative? (Wright, 1997, p 6-7.)

Procedures

The research will start by establishing the criteria that will be used in meeting the technology content standards from *Standards for Technological literacy: Content for the Study of Technology* and questions raised Wright (1997). The criteria for meeting the technology content standards will come from the Compendium of Major Topics for Technology Content Standards. It will determine what standards relate to the module being observed. The module will then be examined to see what benchmarks from the related standards are or are not being addressed. The criteria for meeting the eight questions outlined in Modules: Friend or Foe will come from applying the questions to two modules of each vendor, A, B, and C, and the three instructor's modules to see which vendor, A, B, or C, or the instructors have an effective technology education curriculum.

Analysis

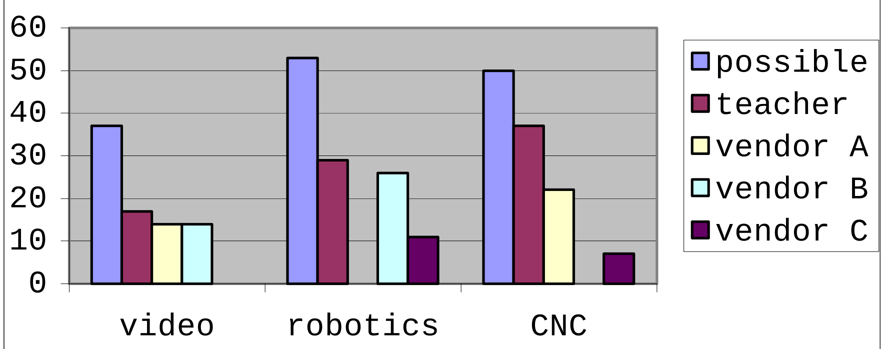
The data from the modules will be compiled to determine what characteristics are or are not being addressed with vendor and instructor written modular technology education. It will then be decided if vendor or instructor written modular technology education curriculum is comparable, or does one do a better job than the other in meeting the criteria set forth. All data will be used to decide if modular technology education is a quality technology education program.

Chapter 4

FINDINGS AND ANALYSIS

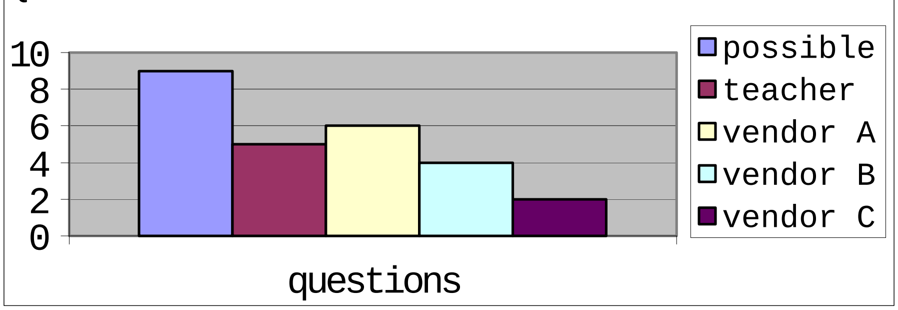
This study examined vendor and teacher-written modules to determine if one was better at meeting the characteristics of a quality technology education program than the other. The first part of the study looked at the 20 national standards for technological literacy and determined what benchmarks each module could cover from the 82 benchmarks listed in the 6-8 grade. It was determined that a video module could address 37 benchmarks from 12 standards, a robotics module could address 53 benchmarks from 18 standards, and a CNC module could address 50 benchmarks from 15 standards. Each module was then worked through to determine what benchmarks were being addressed in each. The findings (figure 1) showed that the teacher-written modules addressed 17 benchmarks in the video module, 29 benchmarks in the robotics module, and 37 benchmarks in the CNC module. The teacher-written modules addressed 59% of the possible benchmarks. Vendor A addressed 14 benchmarks in the video module, and 22 benchmarks in the CNC module. Vendor A modules addressed 42% of the possible benchmarks. Vendor B addressed 14 benchmarks in the video module, and 26 benchmarks in the robotics module. Vendor B modules addressed 44% of the possible benchmarks. Vendor C addressed 11 benchmarks in the robotics module, and 7 benchmarks in the CNC module. Vendor C modules addressed 17% of the possible benchmarks.

Figure 1
Benchmarks Met



The second part of the study looked at the nine questions raised by Wright (1997) and applied them to each of the four subjects observed. The findings (figure 2) showed that the teacher-written met five questions, vendor A met six questions, vendor B met four questions, and vendor C met two questions.

figure 2
Questions Met



Are vendor-made modules superior to teacher-made modules in addressing the national standards for technological literacy? This study concluded that vendor-made modules are not superior to teacher-made modules in addressing the national standards for technological literacy. The reverse was found to be true with teacher-written modules meeting 15% or more benchmarks than vendor-made modules.

What are the main differences in the curriculum supplied by vendors and curriculum created by teachers? The main difference was the amount of time spent doing hands on activities compared to studying content related to the technology education module topic. The more time that was spent on hands-on activities, the less number of benchmarks were addressed by that technology education module.

Can modular technology education be classified a quality technology education curriculum? No, modular technology education cannot be classified a quality technology education curriculum. Only two of the subjects could answer yes to a little over half of the questions. Vendor A received the highest score with six of the nine questions. Teacher-written got five of the nine questions, vendor B got four of the nine questions, and vendor C got two of the nine questions. Every module missed three of the nine questions: a clear definition of technology, encourage cooperative attitudes and teamwork, encourage resourcefulness, and initiative.

Chapter Five

SUMMARY, CONCLUSION, RECOMMENDATION

Summary

Vendors and instructors are creating technology modular education units at a rapid rate. Many of the middle school technology education programs across the country are implementing modular technology education programs to deliver their curriculum. Hopkins Middle Schools have incorporated both vendor-written and teacher-written technology education modules and wonders if there is a difference between the two.

No research could be located that supported one form of technology education modules over the other. Several articles and research could be found that addressed educator’s opinions on modular technology education. A study was then conducted comparing three different module topics. A teacher-written technology education module and two vendors-written technology education modules were compared for each of the module topics. All modules were worked through to see which benchmarks from the *Standards for Technological literacy: Content for the Study of Technology* were being addressed. The four subjects were then looked at individually to see if they meet the nine questions raised by Wright (1997).

Conclusion

The study found that vendor-made technology education modules were not superior to teacher-written technology education modules. Teacher-written technology education modules were in fact better.

The main difference between the curriculum was that some focus most of the curriculum on completing step by step activities related to the technology education module topics and others incorporated both step by step activities and information on real life applications.

Modular technology education cannot be classified as a quality technology education curriculum

Recommendations for the field of technology education

This study raised other topics that should be studied to better answer the many questions raised about modular technology education. Students that have completed vendor-made and teacher-written modular technology education labs should be studied to see what standards they can demonstrate. Modular technology education should be studied to find out what percent of a module is task completion and what percent is conceptual understanding. Cost should be studied to see if there is a large price difference between teacher written technology education modules and vendor-made technology education modules.

Recommendations for Hopkins administrators

Hopkins should continue to write the majority, if not all their technology education modules. Technology education modules that have already been written need to be looked at to see what important benchmarks need to be added to improve the curriculum. The amount of time spent on modular technology education should be keep the same with three out of twelve weeks in seventh grade and three out of twelve weeks in eight grade. Modular technology education does a good job of exposing students to several benchmarks in a short period of time but other teaching methods are needed in the curriculum to guarantee a quality learning experience for the students.

Recommendations for teachers

I would recommend to teachers that are thinking of starting a modular technology education lab or presently have a lab to look at what they want their students to get out of the learning environment. Modular technology education will not meet the entire goal for a quality technology education curriculum. Multiple kinds of facilities are needed if using modular technology education. If only one type of technology education facility will be used for your curriculum, it should not be a modular technology education lab. Once it has been determined that a modular technology education lab will be used in your school, the teachers should write the modules giving the teacher the ability to determine what and how many benchmarks will be addressed. When writing a technology education module teachers needed to find the appropriate amount of hands on activities to include in their modules in order to keep the students engaged in learning. But remember that these activities must be explained as to their relationship to technology in order to make it a true learning activity. It is important to remember that technology education is not about just learning how to manipulate technological objects but more importantly how and why these technological objects operate. The most important part of developing a technology education module is its educational content, not its hands-on activities.

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APENDIX

Table 1 shows the twenty standards in Technology Education from *Standards for Technological literacy: Content for the Study of Technology*. Under each standard are benchmarks describing what topics are to be discussed under those standards. Each standard is analyzed using Video, Robotics, and CNC subject topics. Each subject topic is then addressed as: T for teacher-written, A for vendor A, B for vendor B, and C for vendor C.

Circles are used to represent whether a benchmark can be addressed by Video, Robotics, or CNC subject topics. If a circle is darkened it means the benchmark can be addressed.

Squares are used to represent specific modules under the subject topics. If a square is darkened, it means that the specific benchmark is addressed in the module.

Table 2 shows the nine questions from Wright (1997). Each question is analyzed using teacher-written, vendor A, vendor B, and vendor C. Squares are used to represent these specific technology education module creators next to each question. If a square is darkened, it means that the specific technology education module creator meets the criteria raised in that question.

Table 1

Standards	Video T	Video A	Video B	Robotics T	Robotics B	Robotics C	CNC T	CNC A	CNC C
(1) Students will develop an understanding of the characteristics and scope of technology.									
-Usefulness of technology	●	■	■	■	●	■	■	■	●	■	■	□
-Development of technology	●	□	□	■	●	■	■	□	●	■	■	■
-Human creativity and motivation	●	□	□	□	●	■	■	■	●	■	■	□
(2) Students will develop an understanding of the core concept of technology.									
-Systems	●	□	□	□	●	■	■	□	●	■	■	□
-Resources	●	□	□	□	●	■	■	□	●	■	■	□
-Requirements	●	□	□	□	●	■	■	□	●	■	■	□
-Trade-offs	●	□	□	□	●	■	■	□	●	□	□	□
-Processes	●	□	■	□	●	■	■	□	●	■	□	□
-Controls	●	■	■	□	●	■	■	□	●	■	□	□
(3) Students will develop an understanding of the relationship among technologies and the connections between technology and other fields of study.									
-Interaction of systems	●	□	■	□	●	■	■	■	●	■	■	□
-Interrelation of technological environments	●	□	□	□	●	■	■	□	●	■	■	□
-Knowledge from other fields of study in technology	●	■	■	■	●	□	□	□	●	□	□	□
(4) Students will develop an understanding of the cultural, social, economic, and political effects of technology.									
-Attitudes toward development in use	●	□	□	□	●	■	■	□	●	■	□	□
-Impacts and consequences	●	■	□	■	●	■	■	□	●	■	■	□
-Ethical issues	●	■	□	■	●	□	□	□	○	□	□	□
-Influences on economy, politics, and culture	●	■	□	■	●	■	■	□	●	■	■	□
(5) Students will develop an understanding of the effects of technology on the environment.									
-Management of waste	○	□	□	□	●	■	■	■	●	□	□	□
-Technologies repair damage	○	□	□	□	●	□	□	□	●	□	□	□
-Environmental vs. economic concerns	○	□	□	□	●	□	□	□	○	■	□	□
(6) Students will develop an understanding of the role of society in the development and use of technology.									
-Development driven by the demands, values, and interests	●	□	□	□	●	■	■	□	●	■	□	□
-Inventions and innovations	●	□	□	□	●	□	□	□	●	■	□	□
-Social and cultural priorities	○	□	□	□	●	■	■	□	●	■	□	□
-Acceptance and use of products and systems	○	□	□	□	●	■	■	□	●	■	□	□

Standards	Video				Robotics				CNC			
		T	A	B		T	B	C		T	A	C
(7) Students will develop an understanding of the influence of technology on history.												
-Processes of inventions and innovations	●	□	□	□	○	□	□	□	●	■	□	□
-Specialization of labor	●	□	□	□	●	■	■	□	●	■	□	□
-Evolution of techniques, measurement, and resources	●	■	□	□	●	■	■	■	●	■	□	□
-Technological and scientific knowledge	○	□	□	□	○	□	□	□	○	□	□	□
(8) Students will develop an understanding of the attitudes of design.												
-Design these two useful products and systems	○	□	□	□	○	□	□	□	●	■	■	□
-There is no perfect design	○	□	■	□	●	□	□	□	●	□	□	□
-Requirements	○	□	■	□	●	■	□	□	●	■	■	□
(9) Students will develop an understanding of engineering design.												
-Iterative	○	□	□	□	○	□	□	□	○	□	□	□
-Brainstorming	●	■	□	■	●	□	□	□	●	□	□	□
-Modeling, testing, evaluating, and modifying	○	□	□	□	●	□	□	□	●	■	□	□
(10) Students will develop an understanding of the role of troubleshooting, research and development, inventions and innovation, and experimentation and problem solving.												
-Troubleshooting	●	■	□	□	●	□	□	□	●	□	□	□
-Invention innovation	●	□	□	□	●	□	□	□	●	□	□	□
-Experimentation	●	■	□	□	●	□	□	□	○	□	■	□
(11) Students will develop the ability to apply the design process.												
-Apply design process	●	□	□	□	●	□	□	□	●	□	■	□
-Identify criteria and constraints	○	□	■	□	●	■	■	□	○	□	□	□
-Modeling solution to a problem	○	□	■	□	●	□	□	□	○	□	□	□
-Test and evaluate	○	■	□	□	●	□	□	□	○	□	□	□
-Make a product or system	○	■	■	■	○	□	□	□	●	■	■	■
(12) Students will develop the abilities to use and maintain technological products and systems												
-Use information to see how things work	●	■	■	■	●	■	■	■	○	■	■	■
-Safely use tools to diagnose, adjust, and repair	○	□	□	□	●	□	□	□	●	■	■	■
-Use computers and calculators	●	■	■	■	●	■	■	■	●	■	■	■
-Operate systems	●	■	■	■	●	■	■	■	●	■	■	■
(13) Students will develop the ability to assess the impact of products and systems												
-Design in use instruments to collect data	○	□	□	□	○	□	□	□	○	□	□	□
-Use collect data to find trends	○	□	□	□	○	□	□	□	○	□	□	□
-Identify trends	○	□	□	□	○	□	□	□	○	□	□	□
-Interpret and evaluate accuracy of information	○	□	□	□	○	□	□	□	○	□	□	□

Standards	Video				Robotics				CNC			
		T	A	B		T	B	C		T	A	C
(14) Students will develop an understanding of and be able to select and use medical technologies.												
-Advances and innovations in medical technologies	●	□	□	□	●	■	□	■	○	□	□	□
-Sanitation processes	○	□	□	□	○	□	□	□	○	□	□	□
-Immunolog	○	□	□	□	○	□	□	□	○	□	□	□
-Awareness about genetic engineering	○	□	□	□	○	□	□	□	○	□	□	□
(15) Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.												
-Technological advances in agriculture	○	□	□	□	●	□	□	■	○	□	□	□
-Specialized equipment practices	○	□	□	□	○	□	□	□	○	□	□	□
-Biotechnology and agriculture	○	□	□	□	○	□	□	□	○	□	□	□
-Artificial ecosystems and management	○	□	□	□	○	□	□	□	○	□	□	□
-Development of refrigeration, freezing, Dehydration, preservation, and irradation	○	□	□	□	○	□	□	□	○	□	□	□
(16) Students will develop an understanding of and be able to select and use energy and power technologies.												
-Energy is the capability to do work	○	□	□	□	●	□	□	□	●	■	□	□
-Energy can be used to do work using many processes	○	□	□	□	●	□	□	□	●	□	□	□
-Power is a radar which energy is converted from one form to another	○	□	□	□	○	□	□	□	○	□	□	□
-Power systems	○	□	□	□	●	■	□	□	●	□	□	□
-Efficiency and conservation	●	□	□	□	●	□	□	□	●	□	□	□
(17) Students will develop an understanding of and be able to select and use information and communication technologies												
-Information and communication systems	●	□	□	■	○	□	□	□	○	□	□	□
-Communication systems encode, transmit, and receive information	●	■	□	■	●	■	■	□	●	■	□	□
-Factors influencing the design of a message	●	■	□	■	○	□	□	□	●	■	□	□
-Language of technology	●	□	■	□	●	■	■	■	●	■	■	■
(18) Students will develop an understanding of and be able to select and use transportation technologies.												
-Design and operation of transportation systems	○	□	□	□	○	□	□	□	○	□	□	□
-Subsystems of transportation systems	○	□	□	□	○	□	□	□	○	□	□	□
-Governmental regulations	○	□	□	□	○	□	□	□	○	□	□	□
-Transportation processes	○	□	□	□	○	□	□	□	○	□	□	□

Standards	Video				Robotics				CNC			
		T	A	B		T	B	C		T	A	C
(19) Students will develop an understanding of and be able to select and use manufacturing technologies.												
-Manufacturing systems	○	□	□	□	●	□	□	□	●	■	■	□
-Manufacturing goods	○	□	□	□	●	□	□	□	●	□	□	□
-Manufacturing processes	○	□	□	□	●	□	□	□	●	■	■	□
-Chemical technologies	○	□	□	□	●	□	□	□	●	□	□	□
-Materials use	○	□	□	□	●	□	□	□	●	■	□	□
-Marketing products	○	□	□	□	●	□	□	□	●	■	□	□
(20) Students will develop an understanding of and be able to select and use construction technologies.												
-Construction designs	○	□	□	□	○	□	□	□	○	□	□	□
-Foundations	○	□	□	□	○	□	□	□	○	□	□	□
-Purpose of structures	○	□	□	□	○	□	□	□	○	□	□	□
-Building systems and subsystems	○	□	□	□	○	□	□	□	○	□	□	□

Wright's Questions

Table 2

Wright's Questions	teachers modules	vendor A modules	vendor B modules	vendor C modules
(1) Does the program communicate a clear educational goal?	■	■	■	■
(2) Does the program show evidence of a clear definition of technology?	□	□	□	□
(3) Does the program present a historical perspective of technology?	■	■	■	□
(4) Does the program present the processes or actions of Technology?	■	■	□	□
(5) Does the program present technology through authentic contexts?	■	■	■	■
(6) Does the program present technology as an activity where multiple answers are possible?	■	■	■	□
(7) Dose the program encourage cooperative attitudes and team work?	□	□	□	□
(8) Does the program provide opportunities for open-ended activities?	□	■	□	□
(9) Does the program encourage resourcefulness and initiative?	□	□	□	□