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Middle School Equipment Needs to Teach the Standards for Technology Literacy

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MIDDLE SCHOOL EQUIPMENT NEEDS TO TEACH THE STANDARDS FOR TECHNOLOGICAL LITERACY

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INTRODUCTION

The International Technology Education Association (ITEA), the largest professional educational association for technology teachers, has been the leading force behind technology education. ITEA's mission was to advance technological capabilities for all people and to nurture and promote the professionalism of those engaged in these pursuits (ITEA, 1995). ITEA, working with other organizations, published the *Standards for Technological Literacy: Content for the Study of Technology* (STL) in 2000 and established what students should learn from the study of technology. In 2003, ITEA published *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (AETL), which described how to implement the standards in the classroom. These documents provided what to teach and the recommended knowledge and assessment tools to use when teaching technology.

The organization within the ITEA responsible for developing and disseminating educational materials was established in 1998 and was called the Center to Advance the Teaching of Technology and Science (CATTS). The CATTS consortium consisted of thirteen state members who promoted the use of the *Standards for Technology Literacy* by conducting research on technology education curriculum and providing instructional resources pertaining to the study of technology (ITEA, 1995).

CATTS provided what to teach by promoting the *Standards for Technological Literacy* and promoted the knowledge requirements and assessment tools by providing materials which supported the *Advancing Excellence in Technological Literacy.* However, there was no recommended equipment list provided to support programs. A equipment list was essential in the establishment and growth of a consistent, broad based technology program. Addressing this issue, within middle schools, was the focus of this research paper.

STATEMENT OF THE PROBLEM

The purpose of this study was to establish a master equipment list for middle school technology education programs who have implemented the *Standards for Technological Literacy*.

RESEARCH GOALS

The following goals were evaluated to produce a master equipment list for CATTS to recommend for implementation of technology education at the middle school level:

1. Validate the master equipment list developed by Duffey for middle school technology education (2004).
2. Make changes to the middle school master equipment list based on feedback from Center to Advance the Teaching of Technology and Science (CATTS) consortium state representatives.
3. Recommend a master equipment list for middle school technology education.

BACKGROUND AND SIGNIFICANCE

In 2004 Duffey conducted a research study entitled "The Equipment Needs of the *Standards for Technological Literacy*" and its purpose was to produce a standard equipment list for implementing the *Standards for Technological Literacy*. His intent was to analyze the various CATTS consortium member state equipment lists and compare them to the *Standards for Technological Literacy* to produce a single equipment list that could be recommended and provided by CATTS.

One of Duffey's assumptions was that each state would have an equipment list that met individual technology curriculum programs since all member states had adopted the *Standards for Technology Literacy*. He also assumed that each list may be different, but they would have many similarities. His assumption, that each state would have equipment lists supporting the *Standards for Technology Literacy*, was further supported by the fact that many states had to provide such lists for state and federal funding. Duffey's research discovered that no state of the CATTS consortium had produced an equipment list that fully supported the *Standards for Technology Literacy* and that many of the equipment lists obtained had not been updated to reflect the standards. As recommended by Duffey, this research study focused on the middle school master equipment list.

Developing effective curriculum was not easy and should not be determined by what activities the teacher has available. This analogy was best stated by Reeve in 2002:

> Standards drive the curriculum, not activities. Too often, teachers have large inventories of fun activities at their disposal, and when faced with a challenge of developing a new course or revising an existing course, they start by planning how these activities can be incorporated. This may result in a course that is not standard based. When developing or revising a new course based on STL, curriculum developers must first identify the standards and/or benchmarks that will be covered in the course (p. 34).

The importance of curriculum including supporting equipment lists can not be over stated. An equipment list identifies different kits, materials, videos, etc., that should be used in teaching a particular standard. The master list would ensure that each teacher was provided the equipment to assist in teaching the same information while providing a variety of methods to teach the standard, thus allowing greater flexibility while ensuring the teacher stayed on task. A master list would ensure consistency in the subject while promoting easier assessment of the STL. A master list would provide the teacher an approved shopping list to support allocating resource dollars to purchase items that support the technology curriculum. A master equipment list was required to ensure that all schools and teachers are teaching the standards and not teaching what they have in their lockers or cabinets.

LIMITATIONS

This research was limited to collecting data on a master equipment list that could be used in Middle Schools in states that have adopted the *Standards for Technology Literacy*. Data were obtained from the states that comprise the CATTS consortium. Those states included Florida, Virginia, North Carolina, Utah, Tennessee, Kentucky, Georgia, North Dakota, Wisconsin, Maryland, Missouri, Texas and Ohio. The data collected consisted of written correspondence with CATTS state representatives, as well as obtaining information from individual state web pages. Additional information was obtained from the Occupational and Technical Studies staff at Old Dominion University and the ITEA web page, as well as various articles and books listed in the bibliography.

ASSUMPTIONS

The study focused on middle school technology only and was predicated on three basic assumptions. The first was that a usable equipment list did not exist for middle school technology curriculum programs in any state that was a member of the CATTS consortium who had adopted the *Standards for Technology Literacy*. The second assumption was that the equipment list provided for comment to the CATTS consortium members was a modified version of the middle school material list provided in Duffey's research study and each CATTS consortium member would modify to some degree the list provided by adding or deleting items. The third assumption was that all middle schools possessed or had the ability to obtain basic hand tools necessary for use in middle school technology laboratories, as this study did not address basic hand tools. Additionally, the researcher understood that the data collected would reflect the individual state's requirements and interpretation of the standards as they applied to the middle school technology courses taught in that state.

PROCEDURES

The researcher compared Duffey's recommended middle school list to the standards provided in the *Standards for Technology Literacy* and modified the equipment list. A letter was prepared introducing the research and asking for comment; the letter was co-signed by Dr. John Ritz and forwarded to all CATTS consortium state members via the mail. All CATTS consortium members were given 15 days to review and provide feedback on the proposed master equipment list. As data were returned the master equipment list was modified based on feedback received. When conflicts arose the researcher attempted to contact CATTS members via phone or E-mail to resolve any issue. The researcher produced the final master equipment list based on input received from consortium members and discussions with the staff of the Occupational and Technical Studies Department at Old Dominion University.

DEFINITION OF TERMS

These abbreviations and terms were used in this research report and were defined as follows:

CATTS The Center to Advance the Teaching of Technology and Science (CATTS) is the professional development arm of the International Technology Education Association (ITEA). CATTS promotes the use of the Standards for Technology Education by providing teacher enhancement opportunities through selected programs, workshops, and conferences ranging from the elementary to university level. Additionally, 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 (ITEA, 1995).

ITEA The International Technology Education Association is the largest professional educational association, principle voice, and information clearinghouse devoted to enhancing technology education through technology, innovation, design, and engineering experiences at the K-12 school levels. Its membership encompasses individuals and institutions throughout the world in over 45 countries with the primary membership in North America. ITEA's mission is to advance technological capabilities for all people and to nurture and promote the professionalism of those engaged in these (ITEA, 1995).

Lesson Plan A guide used by teachers containing descriptive course or subject data, goals and/or objectives, rationales, procedures, assignments, materials and equipment and an assessment section (Kellouugh & Kellough, 2003, p. 197).

Master Equipment List A list, which contains projects, kits, displays, videos and other tools, which when used by a teacher can effectively demonstrate one or more of the benchmark topics for a particular standard of the *Standards for Technology Literacy*. The list is prepared by grade level and standard providing numerous activities that can be used to teach and/or reinforce the standard.

Middle School Grades 6, 7, and 8.

STL *Standards for Technology Literacy* outlines the content essential to ensuring that all students attain technological literacy. The standards are built around both a cognitive base as well as a doing/activity base and include knowledge, abilities, and the capacity to apply both knowledge and abilities to the real world (ITEA, 1995).

Technology Education An education, which is problem-based learning utilizing mathematics, science and technology principles (ITEA, 1995).

Technology Literacy Technological literacy is the ability to use, manage, assess, and understand technology. It involves knowledge, abilities, and the application of both knowledge and abilities to real-world situations. Citizens of all ages benefit from technological literacy, whether it is obtained through formal or informal educational environments (ITEA, 2003).

OVERVIEW OF CHAPTERS

In Chapter I, the progress made in Technology Education was reviewed, including an introduction to the ITEA, technology education's largest advocate. Specific accomplishments were discussed including the *Standards for Technological Literacy*. The operational hand of the ITEA, CATTS, was introduced and the observation that curriculum had been developed without a functional equipment list was described referencing Duffey's 2004 research study. Duffey concluded that a master equipment list was needed and this was outlined as the problem of this study. The importance of such a list and its affect on technology teaching was described along with the limitations which would be used to collect data to produce such a list. Finally, the terms relevant to this study were defined.

Chapter II will be a review of the literature on the history of technology education including, the *Standards of Technological Literacy* and CATTS. Chapter II also discusses standardization of technology education programs and the importance of having a standard equipment list to choose from. Chapter III contains information on the methods and procedures used in the research including sources, data collection methods, analysis and summary. Chapter IV includes a review of the equipment list provided by the CATTS consortium member's and their recommendations. Additionally, Chapter IV will list the type of courses taught by each consortium member so the reader will understand why those members selected particular items. Chapter V presents a summary and a recommended master equipment list to be used by the CATTS consortium members in teaching the *Standards for Technological Literacy*.

CHAPTER II

REVIEW OF LITERATURE

The publication of the *Standards for Technological Literacy* (STL) and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (AETL) made significant progress in defining what technology education was and how to assess it. This chapter will briefly review the history of the industrial arts program and describe the transition from industrial arts education to technology education including the importance of the *STL* and *AETL* documents as well as discussion on what steps remained to standardize technology education throughout the country.

BRIEF HISTORY OF INDUSTRIAL ARTS

The industrial arts educational curriculum was based on the study of materials, organizations, tools, processes, products, jobs, and human problems of industry (Maley, 1978). Industrial arts programs became a staple of American public schools teaching the use of hand and power tools to make projects or overhaul pieces of equipment such as small engines. The industrial arts content remained consistent for over 80 years as generations of students went through wood shops, metal shops, power mechanics laboratories and drafting rooms learning about the technical process without understanding the how or why. The classrooms and shop classes remained basically unchanged with the exception of new pieces of equipment occasionally being introduced. Industrial art teachers became comfortable in teaching the same how to lessons without concern for the changes occurring in society and technology. Many educators described industrial arts courses in general as "good for those kids." This shielded them from critics who sought to evaluate their program content in the light of educational reforms and technological advances (Clark, 1989).

TRANSITION TO TECHNOLGY EDUCATION

In the early 1980's a transition was underway; its focus was to move away from the industrial arts program in the public school system. This movement had many names as well as many different directions, all with one intention to change the shop philosophy to something else. This is best summarized by Paul Hook in his article that appeared in *The Technology Teacher Journal*, May/June 2001:

> Technology education has been plagued with an identity crisis over the past decade. As many schools and states moved from the old methods and content of shop and forged ahead with the "new" technologies, our field of study became even more varied, complex, and nondescript to those outside the field, both within and outside of education. Several name changes, many contemporary with each other but conflicting, only added to the confusion. During this time, no national standards existed to clear the confusion about who we were or what we did or even what good we were to the future of our students. Most states did not even have state standards for what was generally an elective course area. Each year or two our name changed, as did the course names, sometimes without any content change. In some districts, an even more disturbing situation occurred, no change at all. The 1980s and 90s were a time of necessary growth, change, pain, and confusion (p. 31).

This confusion and lack of identity was corrected by The Technology for All Americans Project (TfAAP). It

> was created by the International Technology Education Association (ITEA), through funding from the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA). The Project commenced in 1994 and was to be completed in three phases.
>
> Phase I culminated in a document entitled *Technology for All Americans: A Rationale and Structure for the Study of Technology*. This document, published in

1996, lays the philosophical foundation for the study of technology in K–12 laboratory-classrooms. It articulates the essential role of schools in developing technologically literate citizens.

The primary focus of Phase II was content standards for the study of technology. Published in 2000, *Standards for Technological Literacy: Content for the Study of Technology* (*STL*), outlines the content essential to ensuring that all students attain technological literacy. The standards are built around both a cognitive base as well as a doing/activity base and include knowledge, abilities, and the capacity to apply both knowledge and abilities to the real world.

Phase III of TfAAP produced *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*) in 2003. Serving as a companion document to *STL*, *AETL* provides a means for implementing *STL* in laboratory-classrooms by addressing such important topics as student assessment, professional development, and program enhancement. (ITEA, 1995)

Phase I utilized experts of the time to create a document in 1996, which defined what technology education was for grades K-12 and why it was important for students to learn technology. This was a significant step in an attempt to standardize technology education. The next phase was accomplished by a team of educators, who split the K-12 program into sections and developed benchmarks for each. Phase II was completed in 2000 and provided educators and administrators a tool or guide that was used to develop curriculum. The *Standards for Technological Literacy (STL)* contained twenty standards (Appendix A) each having benchmarks following the standard. The benchmarks described the knowledge and ability required for each standard at each of the four grade levels. The four grade levels consisted of K-2, 3-5, 6-8, and 9-12. The *STL* additionally included a chapter describing each of the five major categories that the standards were organized into, which included:

1. The Nature of Technology
2. Technology and Society
3. Design

4. Abilities and the Technological World
5. The Designed World

Each chapter began with a narrative that defined the category, explained the importance of each topic within the category, and gave a brief overview of the chapter (ITEA, 2000, p. 14). The *Standards for Technological Literacy* provided the foundation, which was used to structure classrooms, courses and activities. It was viewed by many technology educators as the beginning of a much needed national shift to unify technology education. Phase III, completed in 2003, and provided the *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (*AETL*) document. This document was designed to work in conjunction with the *(STL)* and viewed by many technology educators as the document that would assist in developing curriculum and activities necessary to teach the standards provided in the *(STL)*. The document contained standards for student assessment, professional development and the program (Appendix B).

> Student assessment standards described effective technological literacy assessment practices to be used by teachers. Professional development standards delineated criteria to be used by teacher educators, administrators, and supervisors in assuring effective and continuous in-service and pre-service education for teachers of technology. Program standards detailed effective, comprehensive educational requirements to be used by teachers, administrators, and supervisors in promoting the development of technological literacy for all students (ITEA, 2005).

The documents stated the purpose was to provide the means to implement the *Standards for Technological Literacy* by providing three vital components. The first was how to assess if the student was learning what was required by the *Standards for Technological Literacy* by defining five student assessment standards (A-1 through A-5) each containing guidelines, which had to be accomplished to meet the standard. This component was to be used to collect data and improve classroom activities, curriculum and teacher skills. The second element was how to prepare technology educators and to ensure current educators and administrators received professional development by defining seven professional development standards (PD-1 through PD-7) with each containing guidelines, which had to be accomplished to meet the standard. This component was to be used to ensure educators and administrators were provided professional development to maintain an expertise on recent tools and processes to teach the ever changing subject of technology. The third was to define the remainder of items that affected student learning and it was called program standards. It consisted of five program standards for teachers (P-1 through P-5), and five program standards for administrators (P-1 through P-5) each containing guidelines, which had to be accomplished to meet the standard. This component was divided into two parts, one covering the teacher responsibilities and the other the administrators or supervisors responsibilities. The Executive Summary for *AETL* stated it was essential that adequate support for professional development be provided by administrators to ensure that teachers remained current with the evolving fields of technology and education (Executive Summary, 2003, p. 7).

The framework for transitioning the industrial arts program of the last eighty years into technology education was now in place. State legislations, state education boards, governors, teachers, local school boards and the federal government began the process of implementing the newly approved and accepted technology education program.

Technology teachers, new and old, required assistance in implementing the *Standards for Technological Literacy*; specifically, the teachers needed curriculum guidelines, exercises and activities, which would support the standards making the transition painless and educational for the students. The *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* provided a roadmap. However, while it was pedagogically sound and supportive for where the program was, what the document did not do was provide the specific tools that teachers could use to get there (Morrow, Robinson, & Stephenson, 2004, p. 27). The Center to Advance the Teaching of Technology and Science (CATTS) organization was intended to help perform that function.

> CATTS was established in 1998 to strengthen professional development and advance technological literacy. CATTS initiatives were directed toward four goals: development of standards-based curricula; teacher enhancement; research concerning teaching and learning; and curriculum implementation and diffusion. CATTS provided teacher enhancement opportunities through selected programs, workshops, and conferences ranging from the elementary to university level. CATTS conducted 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 developed and disseminated educational materials through consortium work involving participants from states/provinces through local educational agencies or groups. Consortium participants received quality products and services specific to their local and professional development needs. CATTS promoted partnerships with agencies, organizations, and other associations to advance technological studies in order to achieve common goals for developing technological literacy and improving student achievement (ITEA, 1995).

The tools, programs and documents were in place to complete the transition from the days of shop work to the new and exciting world of technology education.

WHAT TECHNOLOGY TEACHERS NEEDED

The transition from what was taught in middle school technology classes to the material necessary to meet the *Standards for Technological Literacy* required teachers and administrators to redesign their curriculum. One process that was used with great success was the "backward design", a process developed by Wiggins and McTighe in 1998. The three step process included:

1. Identify desired results
2. Determine acceptable evidence
3. Plan learning experiences and instruction

During the modification or establishment of new curriculum the first objective was to identify which standard or standards would be covered by the course. Too often, teachers had large inventories of fun activities at their disposal, and when faced with the challenge of developing new material or revising an existing course, they started by planning how the fun activities could be incorporated (Reeve, 2002, p. 34). During the second step the designer decided what assessment tool would be used to determine if the student had grasped the appropriate benchmark. This required the teacher to understand the intent of the course and recognize what activities could be used to support the course objectives. The final step was to plan the instruction, selecting textbooks and resources including any equipment that would be used by students in laboratories to support the learning objectives, which matched the standard. This process was conducted in middle schools throughout the country as they made the transition from industrial arts programs to state approved technology courses of instruction conforming to the *Standards for Technological Literacy*. Numerous resources were available including individual state Web sites, ITEA and CATTS web sites, and books such as: *Technology Starters Guide: A*

Standards-Based Guide, Exploring Technology: A Standards-Based Middle School Mode Course Guide, Teaching Technology: Middle School Strategies for Standards-Based Instruction, A Guide to Develop Standards-Based K-12 Technology Education, as well as magazines, journals, state and national sponsored work groups and meetings on developing effective curriculum. During the transition, textbooks were rewritten to incorporate the *Standards for Technological Literacy* and many of the old industrial arts labs or work areas were modified at great expense to what was envisioned as the new modular laboratory. The new modular laboratory would be used to conduct several different activities at the same time with the overview of one instructor or facilitator. Companies selling industrial arts supplies were modified or replaced by companies that offered a variety of kits, tools, and projects covering the core subjects of technology education including transportation, energy and power, robotics, communication, design, modeling, structures, and manufacturing.

PROGRESS TO DATE

Technology education after years of multi-direction was provided a framework to improve. This framework included a set of standards called the *Standards for Technological Literacy (STL)* and the *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards (AETL)*. The *STL* defined what the students should know and what they should be able to do in order to be technologically literate. The *AETL* provided standards and guidelines that addressed student assessment, professional development and program enhancement in order to implement the standards. Specifically, the program standards for teachers P-1 through P-4 (Appendix B) clearly outlined the teacher's responsibility in aligning content of the courses taught in middle schools to that of the *STL*. This included the development and management of learning centers that were up-to-date and provided activities that allowed the student to question, inquire, invent and design based on the *STL*. Additionally, the program standards for administrators P-4 and P-5 (Appendix B) required administrators to articulate and integrate technology programs and provide required funding, support and resources to accomplish mission goals and curriculum objectives. As described in Duffey's 2004 research paper on "The Equipment Needs of the Standards for Technological Literacy", the industrial arts programs provided published equipment lists that were used by teachers and administrators to refit shops and such lists have not been provided for technology laboratories. (p. 17)

Although several years have passed since Phase III of Technology for All Americans was completed, which provided the framework for transformation, teachers, administrators and state educators were still in the process of transforming from industrial arts programs of the past to the technology based programs supported by the *STL* and *AETL*. This was best described by Bybee when he wrote in *The Technology Teacher*:

> Although ITEA and its Technology for All Americans Project have had the major responsibility for dissemination, they can be assisted by state agencies, special coalitions and organizations especially equipped to work on assessments, programs, and professional development. Responsibility and authority for implementation do not necessarily lie with the organizations that develop standards. The organizations can provide support and expertise as well as help in networking various individuals, but they are not always positioned to change policies and practices directly, and they may not be the best source for political activity. State supervisors, curriculum developers, teacher educators, and classroom teachers must assume major responsibility for improving technology education (2003, p. 25)

SUMMARY

This chapter described what the industrial arts program was and how the industrial arts program was transformed into technology education. It further described the importance of the publications:

- *Standards for Technological Literacy* (STL), and
- *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards* (AETL).

These were developed as a result of the Technology for All Americans Project (TfAAP). The purpose of each document was explained including how each was a tool to be used by teachers, administrators and policy makers to reform technology education. Finally, the chapter described what has been accomplished and what remains to be accomplished in improving technology education, explaining the lack of a master equipment list for technology education. Chapter III contains information on the methods and procedures used in the research of a master equipment list including sources, data collection methods, analysis and a summary.

CHAPTER III

METHODS AND PROCEDURES

This research has reviewed the history of technology education including, the *Standards of Technology Literacy (STL)* and *Advancing Excellence in Technological Literacy: Student Assessment, Professional Development, and Program Standards (AETL)*. The research focused on the significance of the *STL* and *AETL* and the importance of standardization and the need for a master standard equipment list. This chapter discussed the details of how data were presented and the process used to collect data. Topics included population, instrument design, and method of data collection, statistical analysis and a summary. Information obtained for this research was collected via letter, E-mail and phone using the master equipment list developed by Duffey for middle schools (2004), as a straw man, and adding to it with the assistance of faculty from Old Dominion University, Occupational and Technical Studies Department.

POPULATION

The population for this research was the thirteen participating states of the CATTS Consortium. The states that comprised the CATTS Consortium were Florida, Virginia, North Carolina, Utah, Tennessee, Kentucky, Georgia, North Dakota, Wisconsin, Maryland, Missouri, Ohio and Texas. It must be noted that Duffey's original research was based on a twelve member CATTS Consortium, which consisted of all the above listed states except Texas. An additional population used for data and advice were the members of the Occupational and Technical Studies Department at Old Dominion University, their experience in teaching technology at all levels of the educational spectrum provided specific recommendations for the master equipment list. Those members included John Ritz, Ed.D., D.T.E., Professor and Chair and Graduate Program Director; Walter F. Deal, Ph.D., Associate Professor; Philip Reed, Ph.D., Assistant Professor; and Hassan B. Ndahi, Ed.D., Associate Professor.

INSTRUMENT DESIGN

Duffey's 2004 recommended middle school equipment list was used as a starting point to produce the middle school master equipment list survey. The researcher expanded Duffey's list utilizing his teaching experience in middle school, knowledge obtained from curriculum on technology education taken at Old Dominion University and recommendations received from the Occupational and Technical Studies Department at Old Dominion University. Duffey's solar power item was expanded by the researcher to include all alternate energy sources and called energy kits. No items were deleted from Duffey's list. Eleven areas were added by the researcher and included career exploration, CNC lathe, desktop publishing, digital photography, Lego mechanical engineering, Lego pneumatics, Lego simple machines, magnetic levitation, robotics and satellite. The document created was called the middle school master equipment list, which provided recommended exercises, kits, videos and demonstrations. The master equipment list provided middle school technology teachers a more detailed list of tools, which, when used, supported the *STL*. The master equipment list for middle school technology education was converted into a survey document and is provided in Appendix C.

METHODS OF DATA COLLECTION

The survey document was forwarded to CATTS consortium members via a cover letter co-signed by Dr. John Ritz and is provided as Appendix D. Consortium members were asked to provide feedback on the master equipment list for middle school technology education survey within fifteen days of receipt. A follow up E-mail was written to all consortium members who did not respond within the requested time. Follow-up phone calls were made by the researcher and Dr. Ritz to consortium members who did not respond to the letter or E-mail. Consortium members were specifically requested to agree or disagree with each of the equipment/resource packages listed on the survey document by placing a check next to each item listed in the space provided or leave it blank if they did not agree. Additionally, the survey requested consortium members to add other resources they felt would be helpful for teaching middle school technology education standards.

STATISTICAL ANALYSIS

Feedback received from CATTS consortium members was analyzed by the researcher and provided in written and table format. Items receiving agreement from seventy percent of the respondents or more was considered valid and remained on the middle school master equipment list. Each item receiving less than seventy percent agreement was evaluated by the researcher with the assistance of the Occupational and Technical Studies Department at Old Dominion University to determine if it should be considered invalid and removed from the middle school master equipment list.

SUMMARY

This chapter outlined how the master equipment list for middle school technology education survey was developed. It also explained how the survey was forwarded to the CATTS state representatives for comment and the directions for commenting on the survey. Additionally, the chapter described the analysis process that was used by the researcher to examine data. Chapter IV reported and displayed the findings of this study.

CHAPTER IV

FINDINGS

The purpose of this chapter was to present the data obtained from CATTS state representatives who responded. The problem of this study was to establish a master equipment list for middle school technology education programs who have implemented the *Standards for Technological Literacy*. This chapter looks at the representatives' responses to the survey on the master equipment list for middle school technology education and reports the findings.

SURVEY RESPONSES

Thirteen survey questionnaires were sent to the CATTS representatives, twelve responded providing a ninety-two percent response rate. Of the twelve who responded, three provided additional items for consideration, which survey results discuss. One respondent who provided feedback wanted the researcher to understand that the state represented by that member does not use the *Standards for Technological Literacy* as course standards, but only as a structure to build courses on. The following paragraphs analyze each of the survey proposed equipment/resource packages and provided the percentages of consortium members who agreed. Table 4-1 provided a summary of the survey results displaying numbers of consortium members who agreed and disagreed, as well as the percentage who agreed. Additionally, the final paragraph provided a summary of additional items recommended by respondents.

SURVEY RESULTS

Aerospace kits allowed students to design, test and collect data to determine the effectiveness of their designed craft including planes, rockets and space craft. These resources met *Standards for Technology Literacy* 1-4, 6-8, 12-13, and 17-18, and were supported by 11 of 12 respondents for a 92% agreement.

Authoring software allowed students to familiarize themselves with different communication tools. These resources met *Standards for Technology Literacy* 1-4, 6-8, 11-13 and 17, and were supported by six of 12 respondents for a 50% agreement.

Bridge building kits allowed students to transfer their vision from paper to reality and test their bridge designs. These resources met *Standards for Technology Literacy* 1-3, 5-13 and 19-20, and were supported by 11 of 12 respondents for a 92% agreement.

Career exploration kits allowed students to explore various technological careers available to them. These resources met *Standards for Technology Literacy* 1-4, and were supported by nine of 12 respondents for a 75% agreement.

CNC lathes allowed students to experiment with computer driven lathes. These resources met *Standards for Technology Literacy* 1-3, 6-8, 11-13 and 17, and were supported by six of 12 respondents for a 50% agreement.

Computer aided design software programs, allowed students to learn the basics of virtual design. These resources met *Standards for Technology Literacy* 1-3, 6-8, 10-13, and 17, and were supported by nine of 12 respondents for a 75% agreement.

CO_2 car kits and racetrack projects allowed students to explore design, production and testing of automobiles. These resources met *Standards for Technology Literacy* 1-13 and 18-19, and were supported by 10 of 12 respondents for a 83% agreement.

Desktop publishing software allowed students to explore and experiment with publishing and page layout, including publishing a class newsletter. These resources met *Standards for Technology Literacy* 1-3, 6-8, 10-13 and 17, and were supported by eight of 12 respondents for a 67% agreement.

Digital photography allowed students to use digital cameras to take pictures and computers to edit pictures. These resources met *Standards for Technology Literacy* 1-3, 6-8 10, 13 and 17, and were supported by nine of 12 respondents for a 75% agreement.

Drafting kits allowed students to learn the basics necessary to create a basic three dimensional drawing. These resources met *Standards for Technology Literacy* 8-10 and were supported by seven of 12 respondents for a 58% agreement.

Energy kits including solar power and wind energy allowed students to explore and understand how alternate sources of energy work. These resources met *Standards for Technology Literacy* 1-12 and 16, and were supported by 11 of 12 respondents for a 92% agreement.

House construction kits allowed students to explore and understand house design and construction. These resources met *Standards for Technology Literacy* 1-3, 8-13 and 20, and were supported by seven of 12 respondents for a 58% agreement.

Hydroponics kits allowed students to experiment in growing plants without soil and discover the advantages of doing so. These resources met *Standards for Technology Literacy* 1-17 and were supported by 11 of 12 respondents for a 92% agreement.

Instructional videos allowed students to view any video that described the history of technology, technological career opportunities and the affect technology has had on society and the environment. These resources met *Standards for Technology Literacy* 1-20 and were supported by nine of 12 respondents for a 75% agreement.

Lego mechanical engineering kits allowed students to investigate material construction with computer integrated parts. These resources met *Standards for Technology Literacy* 1-3, 7-11, and 19, and were supported by 12 of 12 respondents for a 100% agreement.

Lego pneumatic kit allowed students to investigate and experiment with the power of pressure. These resources met *Standards for Technology Literacy* 1-3, 7-11, 16, and 18 – 20, and were supported by 11 of 12 respondents for a 92% agreement.

Lego simple machine kits allowed students to explore simple machines and design objects to accomplish specific tasks using concepts mastered in class. These resources met *Standards for Technology Literacy* 2-3, and 5-13, and were supported by 11 of 12 respondents for a 92% agreement.

Material and processing kits allowed students to design and manufacture a desk caddy using hand tools. These resources met *Standards for Technology Literacy* 1-3, 8, 10, 12-13, and 19, and were supported by seven of 12 respondents for a 58% agreement.

Magnetic levitation kits allowed students to explore the principles of magnetic levitation as well as design and test a maglev vehicle. These resources met *Standards for Technology Literacy* 1-10, 12-13, and 15, and were supported by 11 of 12 respondents for a 92% agreement.

Robotics kits allowed students to explore robotic design and use. These resources met *Standards for Technology Literacy* 1-3, 4, 7, 10-13, and 19, and were supported by 11 of 12 respondents for a 92% agreement.

Satellite kits allowed students to learn and demonstrate how satellites provide communication to the world. These met *Standards for Technology Literacy* 1-4, 6-8, 11-13, and 17 and were supported by seven of 12 respondents for a 58% agreement.

Three of the respondents provided additional recommendations, two referring the researcher to web pages. In both cases the states provided a detailed equipment list citing classroom supplies required such as white boards, chairs and the like. None of the equipment lists investigated on the web provided a correlation to the standards or resources that could be used to teach a particular standard. One respondent recommended including problem solving activities, the researcher determined that all activities on the survey utilize problem solving and did not add the recommendation.

Table 4-1 summarizes the paragraphs above and illustrates the number of consortium members who agreed and disagreed with the proposed equipment/resource package and the percentage of approval.

SUMMARY

Twelve of the thirteen consortium members provided responses via mail, electronic-mail or phone. All responses are illustrated in this chapter, displaying the number who agreed with the master equipment list proposal, as well as the percentage in agreement for each equipment/resources provided. Chapter V presented a summary and a recommended master equipment list for middle school technology education to be used by CATTS consortium members in teaching the *Standards for Technological Literacy* at the middle school, as well as recommendations.

Table 4.1

Response of CATTS Representatives on Middle School

Master Equipment List Survey Questionnaire

EQUIPMENT /RESOURCE PACKAGES	AGREE	DISAGREE	PERCENTAGE AGREEMENT
Aerospace Kits (Rocket Project, Plane Kits)	11	1	92
Authoring Software	6	6	50
Bridge Building Kit	11	1	92
Career Exploration Kits	9	3	75
CNC Lathe	6	6	50
Computer Aided Design Software	9	3	75
$C0_2$ Car Kits and Racetrack	10	2	83
Desktop Publishing	8	4	67
Digital Photography Kit	9	3	75
Drafting Kit	7	5	58
Energy Kits (Solar Power, Wind Energy)	11	1	92
House Construction Kits	7	5	58
Hydroponics Kit	11	1	92
Instructional Videos	9	3	75
Lego Mechanical Engineering	12	0	100
Lego Pneumatic Kit	11	1	92
Lego Simple Machine Kits	11	1	92
Material and Processing Kit	7	5	58
Magnetic Levitation Kit	11	1	92
Robotics Kit	11	1	92
Satellite Kit	7	5	58

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter briefly describes the problem statement and research goals. The significance and limitations of the study, as well as review of how data was collected, will also be explained. Finally, the research conclusions and recommendations for a master equipment list for middle school technology education programs who have implemented the *Standards for Technological Literacy* will be provided.

SUMMARY

The purpose of this study was to establish a master equipment list for middle school technology education programs who have implemented the *Standards for Technological Literacy*. The research goals were to:

1. Validate the master equipment list developed by Duffey for middle school education. (2004)
2. Make changes to the middle school list based on feedback from the Center to Advance Teaching of Technology and Science (CATTS) consortium state representatives.
3. Recommend a master equipment list for middle school technology education.

The significance of this study was that effective curriculum must include a list of resources to ensure the learning objectives are accomplished. Duffey's 2004 research clearly indicated that no state of the CATTS consortium had produced an equipment list that fully supported the *Standards of Technology Literacy*. The intent of this research was to take Duffey's proposed middle school equipment list, modify it and obtain consortium representative agreement to establish a middle school master equipment list, which CATTS would approve for middle school technology teachers. Furthermore it was envisioned by this researcher that this master list would be a starting point and that the master list would become a living document constantly being modified and updated by consortium representatives providing resources, which could be used by new and old technology teachers to meet the *Standards for Technological Literacy*. The population sampled for this study was small, consisting of 13 consortium member state representatives. Despite the small population, the respondents were considered experts in technology education. Twelve of thirteen provided feedback, which was used to produce a master equipment list for middle school technology education.

CONCLUSION

The first goal of this study was to validate the middle school list provided in Duffey's 2004 research. Duffey's 2004 study recommended a middle school equipment list that was validated and used as a starting point to produce the middle school master equipment list survey. The researcher validated and expanded Duffey's list utilizing his teaching experience in middle school, knowledge obtained from curriculum on technology education taken at Old Dominion University and recommendations received from the Occupational and Technical Studies Department at Old Dominion University. Duffey's solar power item was modified by the researcher to include all alternate energy sources and called energy kits. No items were deleted from Duffey's list; however eleven items were added. Items added by the researcher included career exploration, CNC lathe, desktop publishing, digital photography, Lego mechanical engineering, Lego pneumatics, Lego simple machines, magnetic levitation, robotics and satellite. The document created was called the middle school master equipment list and provided middle school technology teachers a more detailed list of tools, which, when used, supported the *STL*. The middle school master equipment list was converted into a survey document.

The second goal of this study was to make changes to the middle school list based on feedback from the Center to Advance Teaching of Technology and Science (CATTS) consortium state representatives. Twelve of thirteen representatives provided responses to middle school master equipment list survey. Despite the fact the data showed the states have varying agendas when teaching technology at the middle school level, the master equipment list for middle school technology was modified based on the feedback provided by the CATTS consortium members. The researcher deleted any resource that did not receive agreement by 70% or more of the CATTS consortium representatives. Resources deleted based on the data collected included authoring software, the CNC lathe, desktop publishing, drafting, house construction, material processing, and satellite activities. Deletion of those resources significantly changed the proposed middle school master equipment list. Additionally, no items were added based on the CATTS consortium representative feedback.

The third goal was to recommend a master equipment list for middle school technology education. The researcher developed a master equipment list for middle school technology education by including all survey resources that received seventy percent or greater agreement from CATTS consortium representatives. The following 14 resources were included. The first resource was aerospace kits. These kits were used after students explored the history of flight, including planes, rockets and spacecraft. The kits allowed each student to design, test and collect data to determine the effectiveness of their designed craft. The second resource was bridge building kits. These kits were used after students explored bridge design including the forces that act on bridges and the materials used to stand up to those forces. The kit allowed students to transfer their vision from paper to reality and test their design. Career exploration kits were the third resource. These kits were used after students investigated the major fields in technology including communication, transportation and production. The kits allowed students to explore various technological careers available to them. The fourth resource was computer aided design software. The software was used after students learned design basics including the history and principles of design. This software allowed students to learn the basics of virtual design. $C0_2$ car kits and racetrack kits were the fifth resource. These kits were used after the students explored the history of the automobile and the impact it has had on society. These kits allowed students to explore design, production and testing of automobiles. The sixth resource was digital photography. These kits were used after students explored the history of photography, including the basic concepts and similarities between digital and traditional photograph. This kit included a digital camera and software to edit pictures taken by the students. The seventh resource was energy kits, including solar power and wind energy. These kits were used after students explored the various forms of energy including alternative energies. These kits allowed students to explore and understand how alternate sources of energy work. Hydroponics was the eighth resource. These kits were used after students learned the basics of hydroponics including the advantages and disadvantages of growing plants without soil. This kit allowed students to experiment in growing plants without soil and discovered the advantages of doing so. Instructional videos were the ninth resource. This included any video, which described the history of technology, technological career opportunities and the affect technology had on society and the environment. Lego mechanical engineering was the tenth resource. These kits were used after students investigated mechanical principles. These kits allowed students to build simple and advanced models and investigate material construction with computer-integrated components. The eleventh resource was the Lego pneumatic kit. These kits were used after exploring the principle of pneumatics including its use. This kit allowed students to investigate and experiment with the power of pressure. The twelfth resource was the Lego simple machine kit. These kits were used after students were taught the concepts of the various simple machines. This kit allowed students to explore simple machines and design objects to accomplish specific tasks using the concepts learned in class. Magnetic levitation was the thirteenth resource. These kits were used after the magnetic levitation principle was discussed including its advantages. This kit allowed students to grasp the magnetic levitation principle while designing and testing a maglev vehicle. The last resource included on the master equipment list for middle school technology education was the robotics kit. These kits were used after the students explored the role that automation plays in industry and understands the basic concepts of robotics. This kit allowed students to explore robotic design. Table 5-1 illustrates the recommended master equipment list based on the data reported.

Table 5-1

Recommended Master Equipment List for

Middle School Technology Education

Aerospace Kits (Straw Rocket Project, Rocket /Plane Kits)
These kits are used after students explore the history of flight, including planes, rockets and spacecraft. The kits allow each student to design, test and collect data to determine the effectiveness of their designed craft.
Meets Standards 1-4, 6-8, 12-13, and 17-18

Bridge Building Kit
These kits are used after students explore bridge design including the forces that act on bridges and the materials used to stand up to those forces. The kit allows students to transfer their vision from paper to reality and test their design.
Meets Standards 1-3, 5-13 and 19-20

Career Exploration Kits
These kits are used after students investigate the various fields in communication, transportation and transportation. The kit allows students to explore various technological careers available to them.
Meets Standards 1-4

Computer Aided Design Software
These kits are used after students learn design basics including the history and principles of design. This software allows students to learn the basics of virtual design.
Meets Standards 1-3, 6-8, 10-13 and 17

$C0_2$ Car Kits and Racetrack
These kits are used after the students explore the history of the automobile and the impact it has had on society. These kits allow students to explore design, production and testing of automobiles.
Meets Standards 1-13 and 18-19

Digital Photography Kit
These kits are used after students explore the history of photography including the basic concepts and similarities between digital and traditional photograph. This kit includes a digital camera and software to edit pictures taken by the students.
Meets Standards 1-3, 6-8, 10, 13 and 17

Energy Kits (Solar Power, Wind Energy)
These kits are used after students explore the various forms of energy including alternative energies. These kits allow students to explore and understand how these alternate sources of energy work.
Meets Standards 1-12 and 16

Hydroponics Kit
These kits are used after students learn the basics of hydro phonics including the advantages and disadvantages of growing plants without soil. This kit allows students to experiment in growing plants without soil and discovers the advantages of doing so.
Meets Standards 1-17

Instructional Videos
Any video, which describes the history of technology, technological career opportunities and the affect technology, has had on society and the environment.
Meets Standards 17 and 14-20

Lego Mechanical Engineering
These kits are used after students investigate mechanical principles. These kits allow students to build simple and advanced models and investigate material construction with computer-integrated components.
Meets Standards 1-3, 7-11 and 19

Lego Pneumatic Kit
These kits are used after exploring the principle of pneumatics including its use. This kit allows students to investigate and experiment with the power of pressure.
Meets Standards 1-3, 7-11, 16, and 18-20

Lego Simple Machine Kit
These kits are used after students are taught the concepts of the various simple machines. This kit allows students to explore simple machines and design objects to accomplish specific tasks using the concepts learned in class.
Meets Standards 2-3 and 5-13

Magnetic Levitation Kit
These kits are used after magnetic levitation principle is discussed including its advantages. This kit allows students to grasp the magnetic levitation principle while designing and testing a maglev vehicle.
Meets Standards 1-10, 12-13 and 18

Robotics Kit
These kits are used after the students explore the role that automation plays in industry and understand the basic concepts of robotics. This kit allows students to explore robotic design.
Meets Standards 1-3, 4, 7, 10-13 and 19

RECOMMENDATIONS

The importance of clear and concise curriculum and equipment cannot be over emphasized. As college graduates enter the field of technology education, they must have direction on how to employ the skills they have learned in college. Without this direction technology education is likely to travel a similar road as that of industrial arts education. The *Standards for Technological Literacy* document and the supporting *Advancing Excellence in Technological Literacy* document have provided clear direction. However, now that direction has been agreed upon, consistent consensus must be established by all organizations responsible for administration and management of technology education. Part of that responsibility is ensuring all middle school technology classes are accomplishing the same objectives throughout the nation. To accomplish that, teachers must be provided an approved curriculum. Part of that curriculum must include an equipment list, which the teacher can use to select activities for reinforcing the teaching of knowledge. The resources or activities must support the class objectives outlined in the curriculum and meet the *Standards for Technological Literacy*. If technology education does not eventually reach that point, politicians, who control the purse strings, may decide that the dollar may be better spent in improving mathematics basics or reading skills, as those subjects have common foundations throughout the nation and do not vary widely from one school system to another.

This research clearly demonstrated the diversity in technology education, not only from state to state, but from school district to school district within each state. Documents have been created and agreed upon to standardize technology education, now leaders, managers and administrators must unite and agree to common curriculum that supports the *Standards for Technological Literacy.* These curriculum must also include a list of possible resources technology teachers may select from to support their instruction and strengthen student learning. The master equipment list for middle school technology education provided is a start and must be continuously updated by administrators to ensure technology educators have the tools they need to teach the future of tomorrow.

Further research in improving and concurring on a nationally approved middle school technology curriculum and a master equipment list for middle school technology education middle school master equipment list is imperative; however such research must be endorsed by CATTS.

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APPENDICIES

APPENDIX A

The Standards of Technological Literacy

The Nature of Technology

Standard 1:

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

Standard 2:

Students will develop an understanding of the core concepts of technology.

Standard 3:

Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

Technology and Society

Standard 4:

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

Standard 5:

Students will develop an understanding of the effects of technology on the environment.

Standard 6:

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

Standard 7:

Students will develop an understanding of the influence of technology on history.

Design

Standard 8:

Students will develop an understanding of the attributes of design.

Standard 9:

Students will develop an understanding of engineering design.

Standard 10:

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

Abilities for a Technological World

Standard 11:

Students will develop abilities to apply the design process.

Standard 12:

Students will develop abilities to use and maintain technological products and systems.

Standard 13:

Students will develop abilities to assess the impact of products and systems.

The Designed World

Standard 14:

Students will develop an understanding of and be able to select and use medical technologies.

Standard 15:

Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.

Standard 16:

Students will develop an understanding of and be able to select and use energy and power technologies.

Standard 17:

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

Standard 18:

Students will develop an understanding of and be able to select and use transportation technologies.

Standard 19:

Students will develop an understanding of and be able to select and use manufacturing technologies.

Standard 20:

Students will develop an understanding of and be able to select and use construction technologies.

APPENDIX B

Advancing Excellence in Technological Literacy; Student Assessment, Professional Development, and Program Standards

Student Assessment Standards

Standard A-1:

Assessment of student learning will be consistent with *Standards for Technological Literacy: Content for the Study of Technology* (*STL*).

Standard A-2:

Assessment of student learning will be explicitly matched to the intended purpose.

Standard A-3:

Assessment of student learning will be systematic and derived from research-based assessment principles.

Standard A-4:

Assessment of student learning will reflect practical contexts consistent with the nature of technology.

Standard A-5:

Assessment of student learning will incorporate data collection for accountability, professional development, and program enhancement.

Professional Development Standards

Standard PD-1:

Professional development will provide teachers with knowledge, abilities, and understanding consistent with *Standards for Technological Literacy: Content for the Student of Technology* (*STL*).

Standard PD-2:

Professional development will provide teachers with educational perspectives on students as learners of technology.

Standard PD-3:

Professional development will prepare teachers to design and evaluate technology curricula and programs.

Standard PD-4:

Professional development will prepare teachers to use instructional strategies that enhance technology teaching, student learning, and student assessment.

Standard PD-5:

Professional development will prepare teachers to design and manage learning environments that promote technological literacy.

Standard PD-6:

Professional development will prepare teachers to be responsible for their own continued growth.

Standard PD-7:

Professional development providers will plan, implement, and evaluate the pre-service and in-service education of teachers.

Program Standards

Standard P-1:

Technology program development will be consistent with *Standards for Technological Literacy: Content for the Study of Technology* (*STL*).

Standard P-2:

Technology program implementation will facilitate technological literacy for all students.

Standard P-3:

Technology program evaluation will ensure and facilitate technological literacy for all students.

Standard P-4:

Technology program learning environments will facilitate technological literacy for all students.

Standard P-5:

Technology program management will be provided by designated personnel at the school, school district, and state/provincial/regional levels.

APPENDIX C

SURVEY

Middle School Master Equipment List

Directions: **Please make an X in front of the equipment/resource packages listed below, if you believe it is appropriate for teaching the *Standards for Technological Literacy* (ITEA, 2000) at the middle school level. Please add other resources you feel will be helpful for teaching the middle school technology education standards. Please return the completed item list in the enclosed envelope by June 15, 2005.**

_____ Aerospace Kits (Straw Rocket Project, Rocket /Plane Kits)
These kits are used after students explore the history of flight, including planes, rockets and spacecraft. The kits allow each student to design, test and collect data to determine the effectiveness of their designed craft.
Meets Standards 1-4, 6-8, 12-13, and 17-18

_____ Authoring Software
Software allows students to familiarize themselves with different communication tools.
Meets Standards 1-4, 6-8, 11-13 and 17

_____ Bridge Building Kit
This kit allows students to transfer their vision from paper to reality and test their design.
Meets Standards 1-3, 5-13 and 19-20

_____ Career Exploration Kits
These kits allow students to explore various technological careers available to them.
Meets Standards 1-4

_____ CNC Lathe
This kit allows the students to experiment with computer driven lathes.
Meets Standards 1-3, 6-7, 11-13 and 19

_____ Computer Aided Design Software
This software allows students to learn the basics of virtual design.
Meets Standards 1-3, 6-8, 10-13 and 17

_____ CO_2 Car Kits and Racetrack

These kits allow students to explore design, production and testing of automobiles.

Meets Standards 1-13 and 18-19

_____ Desktop Publishing

This software allows students to explore and experiment with page layout and publishing including publishing, a class news letter.

Meets Standards 1-3, 6-8, 10-13 and 17

_____ Digital Photography Kit

This kit includes a digital camera and software to edit pictures taken by the students.

Meets Standards 1-3, 6-8, 10, 13 and 17

_____ Drafting Kit

This kit provides the basic tools necessary to allow students to produce a basic three dimensional view diagram.

Meets Standards 8-10

_____ Energy Kits (Solar Power, Wind Energy)

These kits allow students to explore and understand how these alternate sources of energy work.

Meets Standards 1-12 and 16

_____ House Construction Kits

This kit allows students to explore house design and construction.

Meets Standards 1-3, 8-13 and 20

_____ Hydroponics Kit

This kit allows students to experiment in growing plants without soil and discovers the advantages of doing so.

Meets Standards 1-17

_____ Instructional Videos

Any video, which describes the history of technology, technological career opportunities and the affect technology, has had on society and the environment.

Meets Standards 17 and 14-20

_____ Lego Mechanical Engineering

This kit allows students to investigate material construction with computer-integrated components.

Meets Standards 1-3, 7-11 and 19

_____ Lego Pneumatic Kit
This kit allows students to investigate and experiment with the power of pressure.
Meets Standards 1-3, 7-11, 16, and 18-20

_____ Lego Simple Machine Kits
These kits allow students to explore simple machines and design objects to accomplish specific tasks using the concepts learned in class.
Meets Standards 2-3 and 5-13

_____ Material and Processing Kit
This kit includes materials necessary for students to manufacture a desk caddy.
Meets Standards 1-3, 8, 10, 12-13 and 19

_____ Magnetic Levitation Kit
This kit allows students to grasp the magnetic levitation principle while designing and testing a maglev vehicle.
Meets Standards 1-10, 12-13 and 18

_____ Robotics Kit
This kit allows students to explore robotic design.
Meets Standards 1-3, 4, 7, 10-13 and 19

_____ Satellite Kit
This kit demonstrates how satellites help in providing communication
Meets Standards 1-4, 6-8, 11-13 and 17

Thank you for your participation in this study!

APPENDIX D

SURVEY LETTER

May 24, 2005

ADDRESS

Dear CATTS Consortium Representative,

My name is Tom Warner and I am conducting a research study in pursuit of a master's degree in Technology Education. My research is to establish a master equipment list for middle school technology education programs who have implemented the *Standards for Technological Literacy*. I am working with the staff of the Occupational and Technical Studies Department at Old Dominion University, specifically Dr. John M. Ritz.

The original master equipment list was proposed by Duffey in a research report conducted in 2004. It has been modified with the assistance of Dr. Ritz's Department. The intend of the master equipment list is to provide a Middle School Technology teacher with a shopping list of projects, kits, materials and videos that should be used in teaching individual standards. The list will ensure that each teacher is provided a variety of equipment that matches particular standards and could be used in teaching each middle school standard. The master equipment list provides a variety of methods to teach, allowing greater flexibility, but more importantly provides a starting point for each of the standards taught in the Middle School. The master equipment list will help the new and seasoned teacher stay on task, while providing an approved list that can be used to support the allocation of education resources.

Dr. Ritz and I request you provide feedback on the enclosed master equipment list not later than June 15, 2005. Additions, deletions and recommendations to provide the Middle School Technology teacher a starting point as well as tool he/she can use to obtain funding is our hope. Please provide comments via letter or E-mail to the addresses provided. Individual member responses will be analyzed and an aggregate of the results will be provided in the research in which no individual names or states will be identified to any specific data. All data received will be safe guarded by the researcher and his advisor.

Address: or Email: twarner@odu.edu
Tom Warner
Old Dominion University
Occupational and Technical Studies
Education Building Room 228
Norfolk, Virginia 23529-0498

Thank you in advance for support in making the Middle School Technology teachers job a little easier.

Sincerely yours,

John Ritz
Professor and Chair
Occupational and Technical Studies

Tom Warner
Graduate Student

Enclosure