Best Practices

in Technology Education

A Collection of 21st Century Best Practices in Technology Education

G. Eugene Martin
Christopher M. Martin

Published by

TECHNICAL FOUNDATION OF AMERICA
P.O. Box 168
Glen Ellyn, Illinois 60138 USA

Foreword

The Technical Foundation of America convened teams of technology educators in 2004 and 2005 for the purpose of identifying "Best Practices" in technology education. This book identifies and briefly describes selected Best Practices as viewed by the participants of those teams. The foundation's trustees brought to its meetings some of the most respected technology educators in the profession. These individuals, who were nominated by their peers, participated in the important process of identifying *Best Practices in Technology Education* today, with the goal of authoring a description of the practices. This book provides a snapshot of the combined list of Best Practices that resulted from the 2004 and 2005 sessions. The foundation makes no judgment as to the validity of the Best Practices as that judgment must be left to the reader.

What is a Best Practice? What distinguishes a Best Practice from any other practice in technology education? Is a Best Practice related to content, instructional strategies, classroom management, organizational structure and even organizational change, program effectiveness, student learning, teaching effectiveness, or the unique and creative initiatives of individuals? Maybe it's all of these practices and even much more. For purposes of this book, however, a Best Practice in technology education is a human created and directed activity whose purpose is to bring about purposeful change in student learning, teaching effectiveness, and program effectiveness in an exemplary way. A Best Practice adds value to an already existing technology education endeavor.

When the foundation's trustees decided to venture into this new initiative, they knew from the outset that they would never be able to identify all the Best Practices in technology education being practiced today, and those that were identified would even be subject to debate. But debate and discourse are healthy for a profession and maybe this Best Practices' book provides the impetus for healthy discussions in the profession. Similarly, it is the trustees' desire that this book will not only identify and profile some of the outstanding Best Practices in technology education today, but that it will also cause members of the profession to seek additional information about these practices and, where appropriate, implement them in total or in part. Hopefully, the profession's members will communicate with individuals of these Best Practices in order to increase their understanding about the practices.

Individuals and groups who wish to bring about purposeful and meaningful change in student learning, teaching effectiveness, and program effectiveness are the intended audience of this book. They include classroom teachers, supervisors, principals and superintendents, school boards' members, and other key stakeholders who have influence and make decisions about the quality of technology education programs.

While this book represents a beginning to identifying Best Practices, the process has no ending. If the profession finds value in the book's content, then it is the foundation's goal to continue the exercise of identifying Best Practices in order to increase the public's awareness of exemplary practices in technology education. Once identified, the Best

Practices will be added to this “living” book. The foundation invites and actively seeks additional nominations from the profession.

In order to assist the reader in searching for a Best Practice in a particular area, the book is organized into three sections: (a) National and State Initiatives in leadership development, curriculum improvement, and professional collaboration; (b) Local Initiatives in leadership development, curriculum improvement, and professional collaboration, and (c) Classroom Initiatives in student learning, teaching effectiveness, and program improvement. It is abundantly clear that some Best Practices do not belong in just one section but cross boundaries into two or more areas.

The foundation’s trustees are deeply indebted to a group of outstanding technology educators who took valuable time from their already busy personal and professional schedules to identify and author Best Practices. The names of these individuals may be found on an accompanying page in this book.

If you find value in this Best Practices book, please inform your colleagues of its existence. You have permission from the foundation to reproduce any and all parts of it for educational purposes. The book is also available at http://teched.vt.edu/ctte/. If you have any questions about the organization of the book or the procedure that was followed in selecting the Best Practices, please direct them to the foundation.

G. Eugene Martin
Christopher M. Martin
Editors

About the Editors

G. Eugene Martin is Professor of Curriculum & Instruction at Texas State University in San Marcos, Texas. Prior to his current appointment, he served as Director of Extended and Distance Learning, Dean of the School of Applied Arts & Technology, and Chair of the Department of Technology at Texas State. Gene was graduated from Southern Illinois University, Miami University, and the University of Maryland with a bachelor, master, and doctorate degrees, respectively; prior to entering higher education, he was a classroom teacher in the Montgomery County Public Schools of Maryland. He serves on the Board of Trustees of the Technical Foundation of America as President and Chair of its Grants Committee. Gene is an active participant in the technology education profession while authoring numerous articles for various professional journals, and books and monographs. He edited three yearbooks for the Council on Technology Teacher Education with the two most recent yearbooks being *Foundations of Technology Education* and *Technology Education for the 21st Century A Collection of Essays*.

Christopher M. Martin is Vice President of Sales for Summit Resources, LLC in Atlanta, Georgia. Prior to his current appointment, he served as Operations Manager and then Vice President of Operations for Summit. Before he joined Summit in May 2003, he served Hewitt Associates in The Woodlands, Texas as a consultant to Fortune 500 companies for the strategic alignment of vendor relationships. Chris is a graduate of Baylor University with a degree in Business Administration. Chris has attended many state, national, and international technology education conferences and has assisted in the planning and execution of several technology education programs and seminars for the Technical Foundation of America.

Best Practices' Authors

The following individuals participated in meetings to identify and author Best Practices in Technology Education. The foundation's trustees wish to publicly thank each of these individuals for their many contributions that led to the development of this book. The names of these individuals and their addresses/affiliations at the time of their participation are the following:

Sharon A. Brusic
Millersville University
Millersville, PA

Barry Burke
Montgomery County Public Schools
Rockville, MD

Vincent Childress
North Carolina A&T State University
Greensboro, NC

Michael A. De Miranda
Colorado State University
Fort Collins, CO

David Greer
Fort Worth Independent School District
Fort Worth, TX

Marie Hoepfl
Appalachian State University
Boone, NC

Gregory Kane
Connecticut Department of Education
Hartford, CT

Chris Merrill
Illinois State University
Normal, IL

Bill Paige
Clemson University
Clemson, SC

Philip A. Reed
Old Dominion University
Norfolk, VA

Richard Seymour
Ball State University
Muncie, IN

Steve Shumway
Brigham Young University
Provo, UT

Kenneth Starkman
Wisconsin Department of Public Instruction
Madison, WI

Doug Wagner
Manatee County Schools
Bradenton, FL

Table of Contents

National & State Initiatives

Best Practice: *Maryland Engineering Challenges*

Best Practice Nominator: Barry Burke

Description of Best Practice: The Maryland Engineering Challenges are a series of competitions for groups of students in Grades K-12. The Challenges are sponsored by the Engineering Society of Baltimore, the Baltimore Museum of Industry, the Technology Education Association of Maryland, and the National Aeronautics and Space Administration (NASA) with the objective of introducing young people to the role of Engineers in today's society. The competitions involve four main components: (a) written report (sent in two weeks in advance), (b) oral report, (c) design and construction of the entry, and (d) entry's performance at the Museum of Industry. In a typical year, there are three regular challenges at the elementary school level, four at the middle school level, and four at high school level. Additionally, at the high school level, the Wood Bridge Challenge is the regional competition with winners moving on to the finals of the International Wood Bridge Challenge, and an online challenge run by NASA.

Key Contact Person:

Robert C. Gray
Visiting Lecturer
University of Maryland, Eastern Shore
Maryland Center for Career and Technology Education Studies
1201 Topaz Court
Odenton, MD 21113
Telephone: 410.695.2908
Email: bgray@mail.umes.edu
(Note: Mr. Gray is the former Maryland State Supervisor for Technology Education, Executive Director of the Technology Education Association of Maryland, and the Director of the Maryland Center for Career and Technology Education Studies. He is now a visiting lecturer at the University of Maryland, Eastern Shore.)

Best Practice: *Long-term Commitment to an Organization*

Best Practice Nominator: Philip A. Reed

Description of Best Practice: There is no shortage of professional organizations that need active participants. All too often we see one or two people working tirelessly to carry on the mission of the organization. Unfortunately, when these individuals leave, the effects on the organization can be devastating. Organizations need to plan so they have more long-term commitments. For example, the professional society for workforce development, Iota Lambda Sigma (ILS), wrote into their bylaws that the secretary/treasurer position would be a five-year appointment. This was designed to help maintain consistency with organization policy, finances, and other activities. The approach taken by ILS has worked but probably would not work for all organizations. The best way to generate more ideas that could be shared is to contact those leaders that have provided long-term commitments to organizations. Almost all organizations have someone, such as the Virginia Technology Education Association's Jerry Weddle, who has provided strong, quiet leadership for a sustained period.

Key Contact Person:

Jerry W. Weddle
430 Rolling Hill Drive
Rocky Mount, VA 24151
Telephone: 540.334.2423
Email: jweddle@rcs.k12.va.us

Best Practice: *Curriculum Integration through Instructional Materials Development*

Best Practice Nominator: Vincent Childress

Description of Best Practice: The Technology Student Association's (TSA) competitive events are designed to help teachers provide application opportunities for the technology concepts their students learn in the laboratory. However, in their present form the TSA competitive events guide does not address content. There are teachers that focus on the events and not the curriculum. There are teachers that focus on the curriculum and not the events. In an effort to provide readily available content to support the TSA competitive events and simultaneously promote the *Standards for Technological Literacy* (STL), the National Science Foundation funded the Tech-know Project. The instructional materials are also correlated with the *National Science Education Standards* and the *Principles and Standards for School Mathematics*. Teachers, teacher educators, and business professionals collaborated on the development of instructional materials that represent best practices in instructional materials development. The Tech-know materials provide the curriculum content (STL) and short term instruction that are based upon highly motivational TSA competitive events.

The following link provides more information on the Tech-know Project:
http://www.ncsu.edu/techknow/

The following link is to the publisher of Tech-know Project materials:
http://www.cplearning.com/index.html

Key Contact Person:

Richard Peterson
Box 7801
Department of Mathematics, Science, and Technology Education

College of Education
North Carolina State University
Raleigh, NC 27695-7801
Telephone: 919.515.1741
Email: richard_peterson@ncsu.edu.

Best Practice: *Connecticut Technology Education Leadership Council*

Best Practice Nominator: Gregory Kane

Description of Best Practice: The Connecticut Technology Education Leadership Council (CTELC) is comprised of technology education teachers who come together five times a year at different sites across the state to experience firsthand the real world applications of technology. During the past 54 years, the CTELC has met, for example, onboard nuclear submarines, at science centers, and at nautical museums. Members have visited amusement parks to meet with ride engineers, factories to discover the technology behind jet engines, graphic production plants to see unique labeling design and production techniques, radio and television broadcast facilities, and schools that offer unique educational programming. The CTELC has even met at a regional mall to learn about the technology behind designing, building, and operating a multimillion dollar retail facility.

Along with gaining first-hand knowledge of the technological world, the CTELC functions as an advisory group to the State Consultant for Technology Education. The CTELC provides regular contact between the state supervisor and school district leaders of technology education throughout Connecticut. Benefits to members include the following:

- share ideas
- communicate with each other on the status of district level technology education programs
- develop cooperative solutions to mutual problems
- develop new and innovative curriculum directions
- broaden the instructional perspectives of the technology education leadership
- further the cause of technology education

Membership in the organization is open to any technology education professional in Connecticut who is or aspires to be a local, regional, or state leader. Before each meeting, members are mailed a postage-paid RSVP post card and a flyer describing the meeting's location and agenda. Members are encouraged to bring guests to the meeting including students who are enrolled in a Connecticut technology education teacher preparation program.

Following the formal program, the state supervisor provides an update of technology education related activities, grant and professional development opportunities, legislative issues, and general items of interest to the membership. During this portion of the meeting, representatives from other technology education related associations such as the Technology Student Association and the International Technology Education Association have an opportunity to provide informational updates.

Each June CTELC members are invited to share their suggestions for future meeting sites. As part of the leadership development aspect of this council, individual members take responsibility for contacting potential sites and arranging all logistics of the meeting from onsite registration to dinner planning.

Key Contact Person:

Gregory Kane
Connecticut Department of Education
165 Capitol Ave.
Hartford, CT 06106
Telephone: 860.713.6756
Email: Gregory.Kane@po.state.ct.us

Best Practice: *Maryland requirement for One Credit in Technology Education for High School Graduation*

Best Practice Nominator: Barry Burke

Description of Best Practice: In 1993, the Maryland State Board of Education voted to include one credit in technology education for every student to graduate from high school. The requirement was brought about by a number of constituencies, including the business community, engineering associations, Maryland Technology Education supervisors, Technology Education Association of Maryland, and the Maryland State Department of Education. The requirement has evolved to include five overarching standards for what students should know and be able to do:

- Nature of Technology
- Impacts of Technology
- Engineering Design and Development
- Core Technologies
- Designed World

In addition to the one credit requirement for graduation, students select one of three options to graduate, one of which is two credits of *Advanced Technology Education.* In Maryland, these requirements are met through the successful completion of courses that are components of the ITEA-CATTS Engineering ByDesign™ Model Program.

The Maryland Voluntary State Curriculum is a project of the Maryland State Department of Education. Nationally, the task of developing content standards for technology education began in 1995 with the Technology for All Americans Project (TfAAP). The National Science Foundation and the National Aeronautics and Space Administration funded this effort to develop a nationally viable rationale and structure for technology education. The International Technology Education Association's (ITEA) *Technology for All Americans: A Rationale and Structure for the Study of Technology* and the *Standards for Technological Literacy: Content for the Study of Technology* have provided the foundation for Maryland's technology education Voluntary State Curriculum and established the guidelines for what each person should know and be able to do in order to be technologically literate.

As the primary instructional program addressing technological literacy in Maryland, Technology Education's Voluntary State Curriculum aligns with the work being done nationally. It defines in measurable terms what it means for Maryland youth to be technologically literate, and to meet the mandated one credit in technology education for each student to graduate from a Maryland high school. As evidenced in the final report of the Maryland "Visionary Panel," teachers must have access to a precise and challenging curriculum, one that is uniform in content and expectations and fully aligned with state standards. Additionally, teachers must have the technical assistance and support they need to translate curriculum into effective, individualized instruction. The development of the Voluntary State Curriculum for technology education and advanced technology education is the first step in meeting this goal.

Key Contact Persons:

Lynne Gilli
Program Manager
Career and Technology Education Instruction Branch
Maryland State Department of Education
200 West Baltimore Street
Baltimore, MD 21201
Telephone: 410.767.0183
Email: lgilli@msde.state.md.us

Marquita Friday
Technology Education Specialist
Career and Technology Education Instruction Branch
Maryland State Department of Education
200 West Baltimore Street
Baltimore, MD 21201
Telephone: 410.767.0183
Email: mfriday@msde.state.md.us

Best Practice: *Mentoring*

Best Practice Nominator: Philip A. Reed

Description of Best Practice: Ask any leader if a mentor had an impact on them and they will answer with a resounding "yes." However, mentoring is a form of leadership that is often overlooked in formal education settings. Strong mentors usually possess many characteristics. First, they provide opportunities for their protégés to expand their horizons. In technology education, this could be co-presenting at a conference or co-authoring an article. Secondly, they help their protégés to become critical thinkers. This not only requires the protégés to question the activities and actions of others, but to also look inward and question themselves. A third trait of successful mentors is to let the protégés shine. A true mentor would never steal the spotlight. Perhaps the greatest impact a mentor can have is to inspire. An example of a person who inspires is James LaPorte. Jim has chaired and served on numerous masters and doctoral committees and has been active in his professional associations.

Key Contact Person:

James E. LaPorte
533 Oak Ridge Drive
Millersville, PA 17551
Telephone: 717.871.6667
Email: James.LaPorte@millersville.edu

Best Practice: *Statewide Performance Assessment*

Best Practice Nominator: Vincent Childress

Description of Best Practice: Tom Shown, Technology Education Consultant for the North Carolina Department of Public Instruction, and Marie Hoepfl, Associate Professor at Appalachian State University, are field testing student performance assessment in technology education (as well as other CTE programs) as an official statewide assessment and accountability component. Currently, North Carolina assesses student achievement only using standardized multiple choice tests. However, these tests tend to limit the teacher's ability to fully assess technology education including assessment of technological problem solving. Now, in an effort to emphasize and measure the hands-on performance of technology education students at the application level and above, student performance assessment is being field tested at technology education programs across the state. Insofar as this is not a widespread practice of governments and is more valid for measuring achievement in technology education than are standardized written tests alone, this is a best practice. Continuing feasibility research is still underway in the face of a newly revised scope and sequence.

The following link is to the North Carolina Department of Public Instruction's technology education website:

http://www.dpi.state.nc.us/workforce_development/technology/index.html

Key Contact Persons:

Tom Shown
6360 Mail Service Center
Raleigh, NC 27699-6360
Telephone: 919.807.3880
Email: tshown@dpi.state.nc.us.

Marie Hoepfl
Department of Technology
Boone, NC 28608
828.262.3122
hoepflmc@appstate.edu

Best Practice: *Standards-Based Curriculum*

Best Practice Nominator: Steve Shumway

Description of Best Practice: One of the strengths of technology education is the emphasis that is placed on students performing hands-on activities. It is always exciting to go to state and national conferences to see technology teachers sharing their latest developments in learning activities and the gadgets that accompany these activities. Unfortunately, if they are not careful, the technology teachers' curriculum can become a conglomeration of cool activities rather than a curriculum based on the standards for technological literacy.

This mentality of "activities for activities sake" is an easy trap to fall into. After all, if you have 180 middle school students showing up for class the next day, you better have something for them to do or they will find something to do and it may not be what you desire. Coupled with the fact that the some teachers don't have the time and the ability to develop an integrated standards-based curriculum, the result is a curriculum that is driven by activities rather than objectives or standards. Several district and state coordinators are using in-service opportunities to bring groups of teachers together to evaluate their current curriculum to see if it is standards-based and if it is not standards-based, to make curricular changes so that their curriculum more closely reflects the standards for technological literacy.

Accomplishing this task involves more than using a matrix to see which activities align with the standards and benchmarks from the *Standards for Technological Literacy*. Teachers must first identify what they want students to know and be able to do as a result of having participated in technology education classes. Second, the teachers need to identify assessments that will allow them to determine if their students "know and are able to do" technology. Finally, teachers must identify instructional strategies and student learning activities that support the concepts identified earlier.

Key Contact Person:

Steve Shumway
Technology Teacher Education
Brigham Young University
Provo, UT 84602
Telephone: 801.422.6496
Email: Steve_shumway@byu.edu

Best Practice: *Communications*

Best Practice Nominator: Barry Burke

Description of Best Practice: Communicating with Florida technology education teachers is a major task that requires many different strategies. The state supervisor of technology education (past and present) created two electronic instruments to maintain and facilitate communications. Since 1996, an electronic newsletter called the *Tech Flash* has been published monthly to keep teachers, administrators, and the community informed about what's happening in technology education both in Florida and around the country. This was the first statewide electronic publication from the Florida Department of Education and has blossomed into a trend setting way to distribute critical information to the over 2000 Florida technology education teachers, supervisors, and other key stakeholders.

Florida also maintains a Listserv. The Listserv is described as ". . . a new planet in the galaxy - *Planet Technology Education*. The planet was formed on the eve of the ninety-seventh year of the twentieth century to serve as a forum for carbon-based Technology Education life forms." PlanetTE enables participants to communicate, share ideas, and to stay abreast of what is happening in this exciting, constantly changing profession. The state supervisor keeps things moving by providing email updates in addition to the monthly newsletter (*Tech Flash*), which contains information about grants, legislation, free classroom activities, products, technology education job opportunities, and news from around the world pertaining to technology education. In order to be added to the PlanetTE listserv and become a participant of Florida's most comprehensive online resource for technology education professionals. Anyone wishing to receive the listserv should visit: http://www.firm.edu/doe/programs/te_planet.htm.

Key Contact Person:

Mellissa A. Morrow
State Supervisor for Technology Education
Florida Department of Education
Office of Workforce Education
325 West Gaines Street
Tallahassee, FL 32399-0400

Telephone: 850.245.9023
Email: mellissa.morrow@fldoe.org

Best Practice: *State Supervisor Leadership*

Best Practice Nominator: Richard Seymour

Description of Best Practice: Across the country, technology educators often complain about the lack of support and leadership at the state level. Many personnel in the state departments of education seem to gravitate into the position of state supervisor or program specialist due to seniority, political influence, or simply because "no one else would do it." What technology education teachers want and need from personnel in their state's department of education rarely matches what they receive in terms of support, resources, communication, and local assistance.

At least one state supervisor (Michael Fitzgerald) has quickly gained statewide acclaim for being very proactive for technology education. All technology educators in Indiana get an email from the state supervisor (called the Specialist for Technology Education) on practically a daily basis. One of Michael's first tasks after taking office was to identify and locate all the technology education teachers and get their key contact information. School mailing labels, phone lists, and WWW databases were purged and an accurate, up-to-date list was established. Hard work resulted in determining that 1139 teachers were currently teaching at least one technology education class in an Indiana public school or at the university level.

The electronic links that were established became the basis for a communication network in Indiana. A state department WWW site was established for the dissemination of curriculum materials, links to important DOE information, news of grants and research opportunities, conference and workshop information, etc. A message board (listserv) allowed teachers to conduct a public forum on educational issues, classroom activities, state association initiatives, and related topics. The result is that all teachers in Indiana are now involved in technology education activities.

Michael's excellence doesn't stop with his communication efforts. He is constantly visiting public school teachers, working with the teacher preparation programs at three universities, organizing and participating in workshops, and supporting activities of the Technology Educators of Indiana (the state professional association).

As affairs evolve at the Indiana Department of Education, Michael has kept technology education in the mix of many initiatives. This includes discussions about content standards and academic "crosswalks," licensing guidelines, and other emerging issues. He has truly gained respect and appreciation among the educators in Indiana. While Michael's performance may not be unique, he serves as a model state supervisor of technology Education.

Key Contact Person:

Michael Fitzgerald
Specialist for Technology Education
Indiana Department of Education
State House Room 229
Indianapolis, IN 46204
Telephone: 317.232.6990
Email: mfitzger@doe.state.in.us

Best Practice: *Certification of Technology Education Programs*

Best Practice Nominator: Doug Wagner

Description of Best Practice: The State of Georgia has established a system for certification of Technology Education Programs within the state. This certification is intended to recognize those programs that maintain the highest standards. It is also intended to serve as a guide for new programs that are being developed. By following the standards for certification, a quality program can be assured. This program certification process has been developed for high school and middle school technology education programs in Georgia. This process includes a review of instructional facilities and equipment, personnel, administration and support, curriculum, and instruction. This program has a positive track record and could be adopted locally or by each state. The program was funded by the Carl D. Perkins funds and can be utilized by others at little or no cost.

Key Contact Person:

Ron Barker
State Supervisor of Technology Education
Georgia Department of Education
Twin Towers East, Suite 1770
Atlanta, GA 30334
Telephone: 404.657.8316
Email: rbarker@doe.k12.ga.us
Website: http://www.uga.edu/teched/doe/certification.html

Best Practice: *State Curriculum Development*

Best Practice Nominator: Barry Burke

Description of Best Practice: When Maryland's high school graduation requirement was approved in 1993, there was not a consistent curriculum that delivered the State Outcomes as described in the Code of Maryland Regulations (COMAR). In order to focus teachers on curriculum that centered on the core technologies, the Montgomery County Public Schools (MCPS) entered into an agreement with the Maryland State Department of Education and other school districts in Maryland to develop curriculum and activities that delivered the State Outcomes. The collaboration between these agencies provided the impetus for the development of the *Encyclopedia of Technology Education Activities*.

For seven summers, MCPS hosted cross curricular teams of teachers from around the state to write instructional activities. Maryland school systems were encouraged to send teams of teachers in technology education, mathematics, science, social studies, and English. The resulting activities were strong in curricular connections and based on the State Outcomes for Technology Education. Seven volumes of high school activities were produced and three for a revised middle school program – all developed collaboratively with Maryland school systems, and all cross-curricular. These encyclopedias were copied and sent to every county school system and the Baltimore City school system in Maryland as part of the collaboration initiative.

Since the release of the International Technology Education Association's *Standards for Technological Literacy* (STL), these activities are being transitioned to those that reflect the Standards in preparation for the Maryland Voluntary State Curriculum.

Key Contact Person:

Barry Burke
Director
Center to Advance the Teaching of Technology & Science
International Technology Education Association
1914 Association Drive
Reston, VA 20191-1539
Telephone: 301.482.1929
Email: burkebar@comcast.net
(Note: Mr. Burke is the former Director of Career and Technology Education for the Montgomery County Public Schools [Maryland].)

Best Practice: *Technology Education and the Use of Competitive Events*

Best Practice Nominator: Chris Merrill

Description of Best Practice: A competitive event at the public school or collegiate levels of technology education is an important component of students' education in technology education. Competitive events allow students to apply what they have learned in the classroom to an action-based situation. In addition, competitive events allow and encourage students to network with other students from around the state/country.

Perhaps you've heard, "don't let your classes get in the way of your education." While the quote may not be attributed to any one individual, many educators have used it over the years. It implies that valuable, meaningful experiences (even knowledge) can be gained outside the traditional classroom.

This theory leads directly into collegiate students participating in extracurricular activities such as conferences and competitive events. College students benefit greatly from professional activities beyond the routine technology education classroom and laboratory. An effective technology teacher educator realizes the importance of having students participate in educational events and ventures.

Extracurricular activities place significant responsibilities on students as they strive to excel in a contest or professional activity. Energetic teamwork is required so participation often brings a high level of personal commitment. Classroom content that was avoided or didn't seem important at the time often gains relevance. Working under pressure often brings out the best in students (e.g. effort, focus, creativity, and motivation).

Learning is a lifelong venture and anything that can make it fun and more rewarding is tremendous. A Technology Education Collegiate Association (TECA) advisor or sponsor can enhance the lifelong learning of students. Collegiate students who participate in competitive events are going to learn a great deal from an exiting, motivational activity . . . which creates a win-win situation for the student, teacher, and program.

Three examples of student participation in competitive events are the following:

1. One school on the eastern seaboard used to dominate the communication contest at the annual TECA East Coast Regional Conference. The student team from the university used some moderately advanced editing equipment to produce outstanding video productions. Their transitions, titles, and other features were far more sophisticated than the single camera work of other student teams. After a few years of being dominated in the contests, students at other schools decided it was time to become more competitive. The students encouraged their professors to purchase portable editing equipment so that their team’s entries would be comparable. Many universities ended up with new equipment at the urging of faculty advisors and participating students. Over the past decade numerous technology teacher education majors have been exposed to innovative video technologies due to a few TECA students at another institution.

2. TECA leadership teamed with the Society of Manufacturing Engineers to sponsor the TECA manufacturing contest. While relatively few schools entered the regional competitions each year, it is important to note that each team that did enter the competition had 4-6 students on their squad. If only 10-12 teams entered the contest annually, that’s still approximately 50 students who are posed to become better manufacturing educators. Upon graduation, those same 50-plus technology educators shape the lives of dozens of secondary students. Bottom line? TECA manufacturing contests help to prepare students to become better future production teachers.

3. When preparing to leave for a TECA regional conference a few years, one group of students remembered that some video equipment had been purchased a year or so earlier. The faculty member who had placed the order had long left for another university. That meant the camera, editing console, and related equipment were all sitting on a shelf in a back room. The equipment might have stayed there except that a group of TECA students thought it could be used to win an event at that coming weekend's competition. As one might expect, the video materials never made it back to the same shelf. Suddenly every student and several faculty members wanted to borrow the items each week or weekend.

When the discussion turns to best practices, perhaps the adage of ". . . don't let your classes get in the way" is somewhat on target. Technology educators need to realize that today's youth are motivated in many different ways. One successful means of promoting learning and professionalism is through fun, yet rewarding activities that occur outside the normal sequence of required courses.

Some people suggest that it takes a special person to foster a TECA style experience. One must know when to "get out of the way" and let students "grow" on their own. Simply direct or lead the students to a point where they are comfortable and then let them discover a world of professionalism on their own. An individual who has served as a role model in TECA activities is Richard Seymour at Ball State University.

Key Contact Person:

Richard Seymour
Ball State University
College of Applied Sciences and Technology
Department of Industry and Technology
2000 University Avenue
Muncie, IN 47306
Telephone: 765.285.5641
Email: rseymour@bsu.edu

Best Practice: *Leadership Recognition – State*

Best Practice Nominator: Barry Burke

Description of Best Practice: As a result of the success of the Montgomery County (MCPS) Awards of Excellence Program model, the Technology Education Association of Maryland (TEAM) adopted a major awards dinner program to recognize leaders from across the State. Applications for program and teacher excellence awards at the elementary, middle, and high school levels are accepted each spring, reviewed during the summer, and presented each fall at the annual dinner and program. Using a combination of the MCPS model and the International Technology Education (ITEA) model for presenting awards of excellence, TEAM now holds an annual Donald Maley Excellence

Awards program to honor the recipients, members of the school staff, and the Superintendent of Schools in the school district that is receiving the award. School principals and superintendents are recognized with the presentation of plaques and a monetary award from corporate donations. The Master of Ceremony for the awards' program and dinner is generally a technology education supervisor or leader on the Executive Board of the TEAM.

The names of awards' recipients for teacher and program excellence are forwarded to the ITEA so they will be eligible for the national awards at the annual ITEA conference. TEAM pays some expenses for those classroom teachers who will be attending the ITEA conference to receive their awards. These teachers then become an integral part of the TEAM annual "TechExpo" (conference) and present successful practices to other teachers and administrators.

Key Contact Person:

Robert C. Gray
Visiting Lecturer
University of Maryland, Eastern Shore
Maryland Center for Career and Technology Education Studies
1201 Topaz Court
Odenton, MD 21113
Telephone: 410.695.2908
Email: bgray@mail.umes.edu
(Note: Mr. Gray is the former Maryland State Supervisor for Technology Education, Executive Director of the Technology Education Association of Maryland, and the Director of the Maryland Center for Career and Technology Education Studies. He is now a visiting lecturer at the University of Maryland, Eastern Shore.)

Best Practice: *Informing the Profession and Improving the Teaching of Technology Education*

Best Practice Nominator: Chris Merrill

Description of Best Practice: Educational and/or applied research informs us of "best practices or approaches" to use in the classroom. Technology teachers, who are up-to-date with research practices, apply for and obtain funded research projects, or implement research-based practices in the classroom exemplify the practices of technology education.

Educational and applied research should have formative and summative impacts on classroom practice. Often, the public understands that the results of research may ultimately impact the curriculum and teaching practices in the classroom. However, research can also have positive impacts on the teaching-learning process while in formative stages. For example, during a recent curriculum development research project at Illinois State University, undergraduate and graduate students in technology education were employed to participate in the curriculum and make revisions under the direction of a curriculum specialist. While the students did receive monetary compensation, the greater reward was the chance to learn invaluable curriculum development and evaluation skills. Similarly, research and grants activities can afford students the opportunity to participate in professional conferences that they would otherwise not be able to afford. For the past eight years, for example, the Connections Project (a project directed by Michael Daugherty) at Illinois State has been sending 15 technology education pre-service teachers/students each year to a teacher professional development conference in Chicago. Lastly, research and grants activities afford students the opportunities to interact with cutting-edge technologies and curriculum methodologies. For example, in the development of the ProBase curriculum (a National Science Foundation funded project), pre-service teachers/students at Illinois State have had opportunities to experiment with curriculum prototype materials, techniques, and devices that will not be in the public schools for another 4-5 years. In summary, research and grants activities bring pre-service technology teacher education students closer to the cutting-edge of the profession and the activities expose them to the future of the profession.

Key Contact Person:

Michael K. Daugherty
University of Arkansas
107 Graduate Education Building
University of Arkansas
Fayetteville, AR 71701
Telephone: 479.575.5119
Email: mkd03@uark.edu

Best Practice: *Content for the Profession - Standards for Technological Literacy*

Best Practice Nominator: Barry Burke

Description of Best Practice: The development of the *Standards for Technological Literacy* is the most significant initiative in the profession in over 20 years. From the development of the *Rationale and Structure* to the development of the *Standards for Technological Literacy* (STL) and then to the development of *Achieving Excellence in Technological Literacy* (AETL), defining the profession through standards has generated more interest and direction for the profession than ever before. Whether its teacher education institutions, State Boards of Education, school districts, or classrooms, emphasis has been placed on the alignment of programs and strategies with the STL and AETL.

The major purpose of STL is to provide content for the study of technology. Nationally, the purpose of generating standards is for major school reform and to ensure that every teacher is delivering content consistently. The purpose is not to prescribe how the content is delivered, but to base instruction on the content base. Therefore, what the STL and AETL have provided the profession is a baseline to which all programs align.

Key Contact Person:

William E. Dugger, Jr.
Project Director
Technology for All Americans Project
1914 Association Drive
Reston, VA 20191-1539
Telephone: 772.285.1752
Email: wdugger@iteaconnect.org

Best Practice: *Advocacy*

Best Practice Nominator: Richard Seymour

Description of Best Practice: Program and association support comes from many different sources including those individuals who have a recognized name, and often from an "old reliable person" who works more behind-the-scenes. Some of these reliable and experienced educators have developed an impressive track record of service and professionalism. One of these individuals is Gary Wynn of Greenfield Central High School.

Gary is a former state association president and an International Technology Education Association (ITEA) director. His solid stance during the conversion to a technology-based curriculum in Indiana was critical. He was a firm, steady professional advocate for "doing what was best for students."

Today, the technology education program at Greenfield Central High School is hailed as one of the best in the nation. His students have communicated with the International Space Station via their HAM radio sets. An automation facility is in one section of the school's production laboratory. Communication and construction activities are conducted in the technology education department and in the community. The technology education facility provides an exceptional learning environment for all students. Administrators and teachers from across the region come to the school for tours and to see "how" to implement technology education.

While program development and facilities are an important part of the technology education program, what is really happening is that through Gary's actions, he is advocating for technology education. Gary Wynn and Ron Yuill of Lafayette, Indiana have combined efforts to become the driving force and advocates for ITEA's Idea Garden. This global network has enhanced the sharing of activities, news and accomplishments, professional suggestions, and good will in technology education. Gary is particularly active on the website while redirecting messages and providing useful information.

At a time when support, knowledge, and experience are needed on a daily basis, Gary Wynn is on the phone or Internet, attending an important meeting, or hosting fellow educators in his department. Gary is a tireless worker who gets projects accomplished despite what many people might consider roadblocks at home and work. He makes phone calls to influential persons that would intimidate most others, and gets programs highlighted in the media that would escape most people's attention. Gary is a promoter and advocate, using the phone or Internet or his personal vehicle to get to "the right place at the right time."

Key Contact Person:

Gary Wynn
Greenfield Central High School
810 North Broadway
Greenfield, IN 46140
Telephone: 317.462.9211 ext 12118
Email: gwynn@gcsc.k12.in.us
gwynn1@hotmail.com

Best Practice: *9 Defining Features – A Guide for Programs that deliver Technological Literacy*

Best Practice Nominator: Barry Burke

Description of Best Practice: Since the release of the *Standards for Technological Literacy* (STL) in April 2000, there has been considerable debate about what does technological literacy "look like?" Supervisors, teacher educators, classroom teachers, and principals all have a vision of a program that delivers technological literacy. Unfortunately, the problem is that the perspectives are all quite different. Standards Specialists are often asked to provide workshops for states, school districts, or individual schools on the methodology to go about implementing the STL. Once the *Achieving Excellence in Technological Literacy* was developed, however, the picture became clearer, but not clear enough for all to see and understand. A tool was developed (and continues to be developed) that identifies the 9 defining features of programs that deliver technological literacy. These 9 features are the following:

1. Rigorous standards-based curriculum
2. Community involvement
3. Opportunities for professional development
4. Staffing organized to support school structure
5. Facilitative learning environment
6. Standards-based assessments

7. Program is articulated, Grades K-16
8. Work-based/career learning opportunities
9. Research-based instructional strategies

The 9 defining features have been cross-referenced with the STL and the AETL, and defined in language that is understandable by community and building principals. Tools for principals and teachers to use that identify what one would experience if a program is effectively and effectively delivering technological literacy to students is currently under development. This practice is important because there needs to be clear indicators that become the basis for continuous program improvement, as well as an easy way to describe programs to constituent groups.

Key Contact Person:

Barry Burke
Director
Center to Advance the Teaching of Technology & Science
International Technology Education Association
1914 Association Drive
Reston, VA 20191-1539
Telephone: 301.482.1929
Email: burkebar@comcast.net
(Note: Mr. Burke is the former Director of Career and Technology Education for the Montgomery County Public Schools [Maryland].)

Best Practice: *TECA Advisor*

Best Practice Nominator: Richard Seymour

Description of Best Practice: The Technology Education Collegiate Association (TECA) promotes professional involvement among college and university students. Some 50-60 schools have a TECA-affiliated chapter that conducts local club activities and participates in regional and international events.

At one time, being a chapter advisor was relatively simple as life on college campuses was fairly calm versus today's focus on accreditation, FTEs, department budgets, facilities, etc. Students from previous decades were also different as most were traditional majors (right out of high school) and were ready for any class or extracurricular venture. Present-day students, however, have multiple jobs to cover the expense of schooling and they often are married with families. Active participation in club or association activities is challenging at best and literally impossible at some schools.

There are dozens of good TECA advisors in the United States but only a handful of outstanding advisors. One TECA leader seems to always have full involvement and professionalism at his university. Fred Ruda, who is a professor at Fort Hays State University (FHSU), is one of the best known and most widely respected TECA advisors in the nation. He has been honored by TECA with a chapter advisor award and his students often claim association awards. Students from FHSU attend the TECA West Regional Conference and the annual International Technology Education Association conference in large numbers. When they enter the TECA competitive events, they usually take home a plaque.

Fred, like so many in the technology education profession, wears many "hats" such as being a department head on his campus or helping ITEA staff with registration at the annual conference. His true worth, however, is to the students at FHSU where he is a mentor and leader and a constant source of inspiration. His students reflect Fred's professionalism and preparation for success both in life and in the teaching profession.

Key Contact Person:

Fred Ruda
Department of Technology Studies
Fort Hays State University
203 Davis Hall
Hays, KS 67601-4099
Telephone: 785.628.4315
Email: fruda@fhsu.edu

Best Practice: *A Long-Range State Plan for Implementing Standards*

Best Practice Nominator: Barry Burke

Description of Best Practice: The Minnesota State Department of Education and the Minnesota Technology Education Association (MTEA) have teamed to implement standards for technological literacy throughout Minnesota. While the subject of the plan is not unique, the length of time that the partners have set out and the way it will be done is rather unique. The purpose of the Plan in Phase I is to promote the technology education national standards for technological literacy (see *Standards for Technological Literacy*) in Minnesota and to initiate a process to embed the standards in the curricula of all Minnesota schools. The organization responsible for administering funds and coordinating the grant activities is the MTEA. Phase I activities were completed over a two-year time span beginning in July 2001. The primary focus of this initiative is to provide staff development and training opportunities on the Technology for All Americans' (TfAAP) *Standards for Technological Literacy* (STL). The following list describes the strategic objectives and activities of the project:

1. Develop a plan to fully embed the TfAAP standards in Minnesota schools by the year 2015.
2. Focus the 2001 and 2002 MTEA Fall Conferences on the *Standards for Technological Literacy*.

3. Make every Minnesota technology educator aware of the *Standards for Technological Literacy*.
4. Provide copies of *Standards for Technological Literacy* to all Fall Conference attendees.
5. Provide executive summaries to all attendees.
6. Make targeted leaders in every Minnesota school district aware of the *Standards for Technological Literacy* (counselors, boards and administrators).
7. Send executive summaries to school boards, curriculum coordinators, superintendents, department chairs.
8. Develop a database of curriculum coordinators, guidance counselors, and administrators.
9. Create an introductory letter and pamphlet to accompany executive summaries.
10. Select and train a select group of Minnesota technology educators that will serve as standards experts and staff developers for the *Standards for Technological Literacy* in Minnesota.
11. Identify partners and communicate the standards to them as well as identifying opportunities for their support.
12. Develop a tool to assess the extent to which a school's curriculum currently addresses the *Standards for Technological Literacy* and identify the areas of needed curriculum development.
13. Develop a Needs identification tool – Where do you need help? (Based on the *STL* Executive Summary)
14. Use needs assessment data to help determine regional staff development workshops.
15. Provide regional staff development opportunities for Minnesota technology educators to receive overview training on the standards.
16. Establish a forum for the MTEA leadership to create bridges with the Minnesota math and science organizations to integrate or collaboratively support the national standards from all three content areas.
17. Develop an implementation checklist for schools to use to initiate the standards implementation process.
18. Continuously improve programs through targeted and focused regional workshops with teachers.

Further information about the Minnesota Standards may be found Minnesota Technology Education Association's website: http://www.mtea.net/.

Key Contact Persons:

Michael Lindstrom
Assessment Specialist
Professional Development Chair
13111 Kerry St. NW
Coon Rapids, MN 55448
Telephone: 763.506.1115
Email: mike.lindstrom@anoka.k12.mn.us

James Mecklenburg
Minnesota State Specialist for Technology Education
Minnesota Department of Education
1500 Highway 36 West
Roseville, MN 55113-4266
Telephone: 651.582.8682
Email: jim.mecklenburg@state.mn.us

Best Practice: *Website to Enhance Student and Teacher Knowledge*

Best Practice Nominator: Barry Burke

Description of Best Practice: A technology education website (www.techedlab.com) was developed as a nonprofit site to support the efforts of technological literacy for all students and staff that make up the K-12 community. With the slogan, "Preparing Minds for the 21st Century," this unique website strives to offer the best resources in technology education, a reference desk, technology products and services, math and science links, grant and funding information, and a wealth of K-12 educational resources. The site also contains links to pages that have been created for the Career & Technology Education Team in the Montgomery County Public Schools.

The site is linked to 240+ other websites throughout the world. Most of these websites are schools and businesses. Visitors to the website include individuals from New Zealand, England, Russia, and Australia to name just a few. There is not a major country in the world that has not visited the website at one time or another during the 10 years the website has been online. The webmaster receives approximately 1000 emails from the website each week. Many visitors to the website are students asking for information. The website has been awarded three online awards for excellence. The icon awards were received from QR winning site, Web Pilot's Wing Award, and "Eye on the Web" Selected Site of Excellence Award. The site was also recognized by a Queensland, Australia newspaper in 1999.

Techedlab.com is an established site on the Internet. The site was originally constructed to link to the best technology and teaching resources that could be found on the Internet for the webmaster and his students. Even though the webmaster has left the classroom, the focus continues to be on where a student or teacher can get information dealing with technology literacy by linking to resources on the Internet. The cost of the site is personally funded by the webmaster.

Key Contact Person:

Stephen J. Mikulski, Jr.
Instructional Specialist for Engineering, Media & Natural Resources
Career and Technology Education
Montgomery County Public Schools

850 Hungerford Drive, #269
Rockville, MD 2850-1747
Telephone: 301.279.3354
Email: steve_mikulski@mcpsmd.org

Best Practice: *Connections Leadership Development and Student Recruitment through TSA*

Best Practice Nominator: Michael A. De Miranda

Best Practice Description: One of the major events of the year at the Colorado Technology Student Association (TSA) is the Challenge Ropes Course competition. Participating students from several different schools gather to enjoy a day filled with excitement, challenges, the formation of new friendships, and the strengthening of existing relationships. Connections, the annual state leadership conference, taught its participants new leadership skills by presenting them with challenges that required teamwork.

Led by outstanding technology education faculty, Connections' participants are guided through different team-building activities that test each individual's leadership and personal skills. Activities such as transporting 8 people across a river of lava with only 3 wooden planks and a few stepping stones helped participants discover and experience their true leadership potential by forcing them to employ communication and teamwork skills.

For many participants, the highlight was the Leap of Faith element of the ropes course. Generally considered the most difficult part of the ropes course, the Leap of Faith entails a 20 foot climb up a telephone pole followed by a gut-wrenching step up onto the top of the pole. The 180 degree turn on the top of the swaying pole produced an awe inspiring view of the entire Denver landscape. To complete this mentally and physically challenging element, the brave adventurer leaped off the pole to a hanging trapeze perched 25 feet above the cheering crowd below. This part of the course, more than any other part, demonstrated the need for support and encouragement from fellow TSA members. Pamela Wilkins of Littleton High School stated the following: "I know I certainly would not have been able to even attempt the Leap of Faith if it had not been for the encouragement and reassuring comments of my peers."

Overall, the Connections Leadership Conference provided a highly supportive environment for each participant to form relationships with other participants whose friendship potential may otherwise not have been realized. Pamela hopes that everyone who was a part of this amazing conference personally gained from the experience in the form of new friendships and new leadership skills. She believes that her students never would have acquired these skills without experiencing the Connections Leadership Conference.

Pamela started her school's TSA chapter 11 years ago and it has done nothing but accentuate her program. She currently attracts students into her classes through the TSA club. They probably would not have registered for her classes if it had not been for the leadership development and opportunities to participate in TSA.

Key Contact Person:

Pamela Wilkins
Littleton High School
199 E. Littleton Blvd.
Littleton, CO 80121
Telephone: 303.347.7739
Email: pwilkins@lps.k12.co.us

Local Initiatives

Best Practice: *Communications*

Best Practice Nominator: Barry Burke

Description of Best Practice: The Adult, Career and Technical Education (ACT) "*Update*" is a monthly publication that is distributed throughout the career and technical education department in the Manatee County Florida School District.

The ACT *Update* is designed to communicate with teachers, administrators, and the community at the district level. Opportunities for professional development in all areas of career and technical education as well as a focus on technology education are covered in the publication. In addition, the *Update* provides information on a range of topics including, but not limited to the following: No "Teacher" Left Behind workshops, summer camps, academies and smaller learning communities, announcements of new teachers and staff, promising best practices, recognition for awards and shining stars (teachers and support staff), curriculum opportunities, Perkins and funding updates, facility planning progress and updates, advisory councils, legislative information, Technology Student Association dates/information, and ACT dates to remember.

The electronic newsletter is sent to the 320 individuals that have responsibility for career and technical education, plus all district guidance counselors, principals, assistant principals, district administrative staff, industry advisory council members, local workforce boards, chambers of commerce, and other key district administrators across the state. *Update* is a critical tool for open lines of communication and recognizing staff for their hard work and perseverance in career and technical education. All updates can be accessed online at http://www.ManateeACT.com.

Key Contact Person:

Doug Wagner
Director of Adult Career and Technical Education
Manatee County Florida
215 Manatee Avenue, West
Bradenton, FL 34205
Telephone: 941.708.8770 ext 2227
Email: wagnerd@fc.manatee.k12.fl.us

Best Practice: *Construction Technology Partnerships*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Around the country the educational components of technology education vary from state to state. Construction technology, for example, has a strong presence in Florida in the technology education programs. The need to link to business and industry is evident in order to provide students the necessary skills and knowledge to be successful in postsecondary opportunities. In May of 1992, the Academy of Construction Technologies (ACT) was formed as a consortium of several Central Florida Construction Trade Associations, business, and industry partners, both union and non-union. The consortium is dedicated to a partnership with government and the local school boards to "Train our Future Work Force Today!" During the past few years, ACT has positioned itself as a leader and model for the State of Florida in youth apprenticeship training for high school students in construction careers. This program has successfully made the link between education and the business and industry partners. Bradenton and Sarasota used this model to implement Construction Technology Careers (CTC), which was founded after the successful Orlando program model in 2001, and they have applied the model with tangible success (showing that this model can be replicated over and over again to achieve a solid best practice).

Key Contact Person:

Kristey Richardson
CTC Careers Coordinator
Construction Technology Careers Coordinator
1750 17th Street, Bldg. J2
Sarasota, FL 34234
Telephone: 941.361.6090 ext 113
Email: ctcinfo@swdb.org
Website: http://www.ConstructionTechnologyCareers.org

Best Practice: *Science Academy*

Best Practice Nominator: David Greer

Description of Best Practice: The Science Academy in Mercedes, Texas offers a program that is unique in that it serves as a magnet school district for 28 surrounding independent school districts in South Texas. The students, typically Hispanic, represent families who come from low socio-economic conditions. Students apply to attend this technology-centered school, some riding the school bus for 1½ hours each way. When students do not perform to expectations, they receive academic counseling.

The program has strong administrative support from the supporting school districts. The six teachers in the program focus on curriculum integration and curriculum development. Although the Academy has good quality equipment, it is not necessarily the latest and greatest of that which is available. The school has no extracurricular activities such as band, athletics, etc.

Every student in the Academy takes technology education. The technology education program is integrated into the core subject areas taught at the academy. School structure and organization is setup to integrate the entire curriculum into a technology format. Counselors at the Academy are charged with seeing that each and every student receives a scholarship to a university including universities such as Harvard, Yale, MIT, Rice, etc.

Key Contact Person:

Mark Schroll
The Science Academy
South Texas ISD
100 Med High Dr
Mercedes, TX 78570-9702
Telephone: 956.565.2454
Email**:** Mark.Schroll@STISD.net
Website**:** https://.www.scitech.stisd.net

Best Practice: *Technology Education Adventures Summer Camp*

Best Practice Nominator: Doug Wagner

Description of Best Practice: This two week educational opportunity allows children in grades 3 to 8th to gain hands-on experience using materials found in the technology education labs. The participants build projects of real things on a model scale during a summer camp. Projects may vary from the simple to the highly complex, depending on the child's age and ability level. Computer programs, digital video production, computer graphics, and community speakers in related fields are also a part of the summer camp program. Children gain an understanding of business and marketing strategies as they develop commercials to advertise their creations. This is an exciting and enriching technology education experience for any motivated student. Dennis Scott at Westwood Middle School has offered this camp the last 14 summers at his middle school as a way to market his program, increase program choice during the school year, and to provide him extra income as a 10-month teacher. The cost for the students to attend is $440.00 for the 10-day, 9:00 to 5:00 program. His school Principal supports the summer camp as a way to showcase the positive offerings at their school. Summer Camps can be replicated across the country as a way to penetrate the elementary school market with technology education, provide positive programs for the students, schools, and community, and give the teachers extra income as an incentive to stay in the field of teaching.

Key Contact Person:

Dennis Scott
Technology Education Teacher
Westwood Middle School
2730 NW 105th Drive

Gainesville, FL 32606
Telephone: 352.955.6718
Email: scottdjsx@yahoo.com
Website: http://www.sbac.edu/~scottdj/

Best Practice: *Local Leadership Development*

Best Practice Nominator: Barry Burke

Description of Best Practice: In a school system of 140,000 students with 60 secondary schools and over 125 technology education teachers, building the capacity for leadership is the key to future success for any program. More often than not, teachers typically do not envision themselves as leaders, nor do they understand the impact of developing leaders that later move into increasingly more responsible positions in the school system. In order to plant the seeds of leadership within the Montgomery County Public School (MCPS) system, one week in early July is designated as "Leadership Week." The school system sets aside the week for curriculum supervisors (central office-based personnel) to work with school-based resource teachers. In MCPS, a system has been set up for these resource teachers to nominate "future leaders" who might benefit by their attendance at Leadership Week. In addition, females and people of various ethnic backgrounds are strongly recruited to attend and participate in Leadership Week.

The week begins with a kick-off and a "State of the County" report that includes a listing of promotions, retirements, curricular changes, etc. During the remainder of the week, teachers attend workshops that focus on two topics: (a) developing leadership and (b) developing technical skills. Participants attend special panel discussions that bring in a range of experience from veteran teachers that have been promoted from teacher to resource teacher, from resource teacher to specialist, and from specialist to principal. Even mock interviews are conducted that focus on what to do and what not to do. At the mid-week point, commercial vendors display their products and the proceeds from their registration fee pays for the cookout luncheon on Friday afternoon. Special awards are presented at this time to those who have distinguished themselves during the week.

Participants in Leadership Week have moved on to more responsible leadership positions in the school system. At last count, 26 teachers had moved into the position of resource teacher; nine had moved from resource teacher to specialist or academy coordinator; and seven had moved into administrative positions that include curriculum coordinators, assistant principals, and principals.

Key Contact Person:

Barry Burke
Director
Center to Advance the Teaching of Technology & Science
International Technology Education Association

1914 Association Drive
Reston, VA 20191-1539
Telephone: 301.482.1929
Email: burkebar@comcast.net
(Note: Mr. Burke is the former Director of Career and Technology Education for the Montgomery County Public Schools [Maryland].)

Best Practice: *High Tech School for Technology and Engineering*

Best Practice Nominator: David Greer

Description of Best Practice: Carver High School For Applied Technology/Engineering/Arts is a magnet school for the Aldine Independent School District in Houston, Texas. With strong administrative support, this program has abundant and excellent equipment to support a strong curriculum. The school has a full offering of student learning activities including extracurricular activities.

The student population predominantly comes from low socio economic neighborhoods with a history of strong gang-related activities. However, students are very successful academically and function well in a technology setting.

The technology education program's framework focuses on the integration of math and science in an engineering setting. The program is unique as it infuses both a technology education format with the usual state course offerings, but also includes a Project Lead The Way curriculum offering. Students attend the school fulltime. The school's campus is adjacent to a community college and many of the students are dual enrolled in the community college while earning college credit.

Key Contact Person:

Mary Braden
Carver High School For Applied Technology/Engineering/Arts
Aldine ISD
2100 S Victory Dr
Houston, TX 77088-7699
Telephone: 281.878.0310
Email: MBraden@Aldine.K12.tx.us

Best Practice: *Leadership Recognition*

Best Practice Nominator: Barry Burke

Description of Best Practice: Administering a school system as large as the Montgomery County Public Schools (140,000 students, 37 middle schools, 23 high schools, and 125 technology education teachers) requires a team effort from teachers, administrators, and the community. Many individuals perform a major leadership role and when asked step up to the challenge of providing leadership by presenting best practices, mentoring others, developing curriculum, and participating in activities that help others grow professionally, they do so without hesitation. Recognizing these individuals for their support is critical to building capacity and continuous improvement of program and staff.

An Awards Program was held each year to recognize professional staff, corporations, and people in the community. Teacher Excellence and Program Excellence (modeled after the International Technology Education Association's [ITEA] awards), Innovation in Education, Counselor Award, and New Teacher are the major awards presented at the program. In addition, teachers and individuals in the community are recognized with framed certificates for their ongoing support. Two teachers (not central office personnel) are chosen as the Masters of Ceremony to orchestrate the evening's activities and to present the awards. The Awards Program is supported through donations from the business community. The donations provide a monetary award for each major award recipient, dinner for the recipient's guests, and promotional materials. The night of the Awards Dinner/Program, a CEO of a local high-tech company delivers the keynote address and high-level school system staff person (associate or deputy superintendent) presents the awards to the recipients. The highest honor is one award that is presented to an individual that has provided support to the district and to classroom teachers. The recipient of the award is usually a high ranking official in the school system or local government. This type of award is a political win-win for sustaining technology education in the school system and the community. Photos and marketing packages are provided to local newspapers, television stations, and the schools of the award recipients. In any given year, there are 12 to 15 major award recipients, and over 100 Certificates of Appreciation presented. The program creates excitement and teachers "talk" about the program throughout the year and look forward to the professionally detailed event. The names of Teacher and Program Excellence award recipients are forwarded to the Technology Education Association of Maryland so they will be eligible for their annual awards and the ITEA awards.

Key Contact Person:

Barry Burke
Director
Center to Advance the Teaching of Technology & Science
International Technology Education Association
1914 Association Drive
Reston, VA 20191-1539
Telephone: 301.482.1929
Email: burkebar@comcast.net
(Note: Mr. Burke is the former Director of Career and Technology Education for the Montgomery County Public Schools [Maryland].)

Best Practice: *Get Technology Education Teachers Working (In The Real World)*

Best Practice Nominator: Doug Wagner

Description of Best Practice: A majority of Manatee County School District's technology education teachers have been teaching for many years and have not had the opportunity to work in the real world. Four years ago, the school district set-up a program entitled Teachers in Industry for Educational Support (TIES). The program is made up of the TIES Information Sheet, TIES Application for Participation, and TIES Training Agreement. The teachers are to select, contact, and make application to a business directly related to their technology education teaching assignment. All documents are completed by the teacher and returned to the district's office in order to be considered as a participant. Teachers then go to work during the summer for 80 hours and are paid for their time. After the experience has been concluded, teachers create a PowerPoint synopsis of the work experience and share it with all of the other technology education teachers in the district. This is a great way for teachers to learn firsthand what business is really looking for in an employee while increasing their own skills and knowledge in the area of technology education.

Key Contact Person:

Doug Wagner
Director
Adult, Career and Technical Education
Manatee County School District
325 Manatee Avenue West
Bradenton, FL 34205
Telephone: 941.708.8770 ext 2227
Email: Mail@DougWagner.com
Website: http://www.ManateeACT.com

Best Practice: *School System Reform*

Best Practice Nominator: Barry Burke

Description of Best Practice: Alignment of programs to a prescribed set of national standards is a task that takes a multi-faceted strategic plan. In order to deliver on the intent of the *Standards for Technological Literacy* (STL), it is critical to build capacity. In the public schools today, it is not enough to have "warm bodies" delivering instruction. When aligning programs and implementing change in the Montgomery County School System (a school system of 140,000 students, 37 middle schools, and 23 high schools with 125 technology education teachers), a major organizational task with a shared vision for the future is required. The process also requires a well thought out plan for (a) creating standards-based curriculum, (b) creating a professional development plan that creates a professional learning community, (c) implementing a standardized assessment plan, and (d) creating a public relations/marketing plan for dissemination to teachers and the community.

The creation of the standards-based curriculum involved the Technology for All Americans staff who was responsible for the development of the STL. Using templates and a structure, a framework for the development of standards-based themes and activities was developed. Some themes and activities that reflected the standards have been updated to be standards-based. The professional learning community has been developed through meetings (mostly voluntary) of teachers on a periodic basis. This provides an opportunity for the curriculum coordinator to answer questions, mentor leaders, and for those individuals who attend to network with their peers. The assessment plan is based on achievement of the standards. While this step is still under development, the teachers who are involved in the professional learning communities are integrally involved in the development of the assessment. Marketing the standards-based model to the community began with presentations to the Business Roundtable for Education's Technology Committee. Setting the stage for the study of technology in the context of the STL gave the Roundtable members an understanding of technology as a tool vs. technology as computers. By continuing these types of public relations efforts to the Parent Teachers Association and to curriculum supervisors (mathematics, English, science, social studies, and reading), the standards have paid dividends to a better understanding of the STL, and how the STL may be implemented in classrooms and infused into cross-curricular themes/activities.

Key Contact Person:

William Ed Ball, DTE
Coordinator
Engineering, Media and Natural Resources
850 Hungerford Drive #269
Rockville, MD 20850
Telephone: 301.279.3439
Email: William_E_Ball@mcpsmd.org

Best Practice: *Positive Community Relations Through Robotics*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Technology education programs have a history of doing a poor job of receiving media coverage regardless of the positive student-centered events that take place each year. Miami-Dade County Public Schools has embarked on a new robotics effort which is a structured competition held annually during the county fair. In preparation for this event, paid in-service is provided by the county office on an annual basis for all technology education teachers. The in-service centers around the new technology, and the design, production, and use of robotics. Teachers are given the rules and entry materials to use with their classes that compete in February of each year. The event packs the fair hall with parents, students, and community stakeholders. The media has a field day, with many positive spin offs resulting from the event. What makes this competition different from the structured Technology Student Association type state and national competition is that it is hosted locally so all parents, administrators, and students may attend. Local businesses are willing to support the effort and it links with the annual teachers' in-service. Participation among teachers has been building within the county and re-energizing teachers' enthusiasm to be a part of the winning team. Math and science teachers have been invited into the partnership and it is indeed a promising program. This is the fourth year of project's implementation.

Key Contact Person:

Tom Cummings
Technology Education Supervisor
Miami-Dade County Public Schools
1450 North East 2nd Avenue, Room 817
Miami, FL 33132
Telephone: 305.995.1877
Email: TCummings@sbab.dade.k12.fl.us

Best Practice: *Cooperative Relationships*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: Chip Miller and the Technology and Pre Engineering programs at Summit High School make extensive use of professionals from the engineering and architecture communities. Chip states that "we have excellent working relationships with the professional engineers of Oregon, and local architectural firms." This practice supports the novice expert relationship often touted in the research literature that argues that novice learners when allowed to interact or have experiences with experts model their learned behaviors and though processes.

Students connect with professionals thereby enhancing future career training and work-based opportunities. Local professionals become aware of the teaching-learning activities within his classrooms.

Key Contact Person:

Lemuel "Chip" Miller, DTE
Summit High School
Bend – La Pine School District
2304 Clearwater Drive
Bend, OR 97701
Telephone: 541.322.3204
Email: lemiller@bend.k12.or.us

Best Practice: *A Technology Education Consumable Supply Procedure*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Technology education has always been in need of a large budget for hands-on consumable supplies. Most teachers believe that they do not receive adequate funds to have the students participate in the planned activities; however, most teachers will ask for funds with no documentation that they are helping move education forward. The Manatee County School District has developed a voluntary, fair, and equitable method for teachers to document their participation and efforts that move the technology education program forward. This method is based on submitting appropriate documentation in the following areas: Rigorous and Relevant Curriculum, Tools, Equipment & Safety, Recruitment and Articulation of Students, Legislative Content Area Support, Professional Development-Content Area, Professional Participation-Content Area, Community/Guidance/Principal/Support Center Visits, Positive Public Relations, and Awards Teacher/Student/Program and Student Achievement.

Key Contact Person:

Doug Wagner, Director
Adult, Career and Technical Education
Manatee County School District
325 Manatee Avenue West
Bradenton, FL 34205
Telephone: 941.708.8770 ext 2227
Email: Mail@DougWagner.com
Website: http://www.ManateeACT.com

Best Practice: *Commitment to Elementary Technology Education*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: Hermosa Valley School includes grades 3 through 8. The middle school, which includes grades 6 through 8, has a technology education laboratory. Teachers and students in the elementary grades, which include 3 through 5, integrate technology education into their core curriculum studies. An area within the technology education laboratory has been designated for elementary student-learning activities. The administration, staff, and parents value technology education as a crucial subject in the education of all students.

The technology education program at the elementary level has been funded through local grants from the TRW corporation, the Hermosa Beach Education Foundation, and a local Kiwanis. The school district has funded in-services activities, conferences, and in-house training in technology education for the elementary teachers. Many of Hermosa's staff members have participated in teaching other faculty at the annual conferences of the

California Industrial Technology Education Association and the International Technology Education Association.

For the past three years the elementary teachers, along with the Exploring Technology Education Association of California, have been developing a series of instructional activities and offering professional development training called "Elementary Boot Camps" for technology education at the elementary grade levels. These "Boot Camps" were so popular that California State University Los Angeles secured a grant to develop an additional unit in Graphic Arts Communication. There is currently a series of five "Boot Camps" covering technology content in electronics, manufacturing, graphic arts, plastics, and transportation.

Hermosa's teachers participated in both designing and providing professional development training in technology education integration for elementary school teachers within their school district as well as 13 other local school districts in the ADTECH Consortium. As part of the total educational program, this project will further augment activities that will integrate math, science, communication skills, and technology at the elementary school level.

Each grade level has integrated one or more student learning activities each year. The goal is for every teacher in grades 3 through 5 to integrate a minimum of two technology activities into their core curriculum this year. The elementary technology standards in the *Standards for Technological Literacy* (STL) as well as California state standards are embedded in each activity.

The goals of this program include the following:

1. Provide leadership in integration of a standards-based technology education curriculum for elementary grades 3 through 6.
2. Conduct and evaluate professional development workshops for elementary school teachers to provide training for the implementation of technology education boot camps.
3. Publish and disseminate the elementary school technology education boot camp teacher created materials via our school district's website. An example of these boot camp activities in the 3rd grade includes teachers integrating manufacturing and transportation technology units of study into their yearly lessons.

The standards listed below (all based on the *Standards for Technological Literacy* for elementary grades) provide the basis for the 3rd grade projects:

1. Students describe the physical and human geography and use maps, tables, graphs, photographs, and charts to organize information about people, places, and environments in a spatial context.
2. Students identify geographical features in their local region (e.g., deserts, mountains, valleys, hills, coastal areas, oceans, lakes).

3. Students trace the ways in which people have used the resources of the local region and modified the physical environment (e.g., a dam constructed upstream changed a river or coastline).

As students learn about geographical features in 3rd grade, a small group of 8th grade students design and build four different terrains on which to test vehicles. Each terrain represents one of the geographical features encountered in the Westward Movement unit of study. Third grade students are given a transportation design brief and are directed to design a tire for a specific terrain. A design process sheet is handed out and shared with the entire class. Each student is asked to sketch a few different tire designs on their design sheets. Every student builds a chassis for his or her vehicle.

One 3rd grade class teamed up with an 8th grade class to complete this part of the project (peer reciprocal teaching). Once the chassis was completed, the 3rd grade students were given the task of making tires for their vehicle and specified terrain. Each student was then given the opportunity to test his or her vehicle on the terrains. Once all vehicles were tested, students talked about and reflected on modifications that they could have made on their vehicles to improve performance.

The manufacturing project was developed to teach students how common items are manufactured. Students are taught input, process, and output of a manufacturing system. Concurrently, the 3rd grade students discuss production line processes verses team manufacturing. For this lesson, the class was divided in half. One-half of the class manufactured a covered wagon using the line production method. The second half of the class manufactured a covered wagon using the team approach. Students shared experiences when they completed the project.

These activities allow students to learn a significant amount of engineering skills in their projects. All of the projects are based on giving students a “real life” contextual problem in which they are to solve (situated cognition).

Key Contact Person:

Teri Tsosie
Hermosa Valley School
1645 Valley Drive
Hermosa Beach, CA 90254
Telephone: 310.937.5888 ext 223
Email: ttsosie@bnet.org

Best Practice: *Getting TSA Started and Moving Forward*

Best Practice Nominator: Doug Wagner

Description of Best Practice: The Technology Student Association (TSA) should be an integral part of every technology education program; likewise, around the country you will find technology education teachers voicing their concerns that funding for this co-curricular educational component is lacking in their schools, which equates to no chapters. Based on a best practice from Mike Ribelin at Littleton Public Schools in Colorado, a TSA Implementation Checklist was developed four years ago. The Checklist serves as a mechanism for fund allocation and in some parts of the state for teacher supplements. Each chapter receives the Checklist and works all year to complete as many areas as possible for points. At the end of the year, a document is submitted with points correlated to dollars for support for the TSA chapter. The procedure is working wonderfully with many districts implementing the program. We live in an area of performance based funding and having integrity with the taxpayer's dollars is critical in today's market. This time-tested best practice is reproducible all over the country, with guaranteed positive results.

Key Contact Person:

Doug Wagner
Director
Adult, Career and Technical Education
Manatee County School District
325 Manatee Avenue West
Bradenton, FL 34205
Telephone: 941.708.8770 ext 2227
Email: Mail@DougWagner.com
Website: http://www.ManateeACT.com

Best Practice: *Learn From The Best*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Technology education teachers across the county have a tendency to stay in their classrooms and not get out and visit exemplary programs. The Manatee County School District has set-up a program entitled Programs In Practice, which is in its fourth year of implementation. Every technology education teacher has the opportunity to spend two days visiting other programs in their content area. The school district provides the funds for substitute teachers and travel expenses through the Perkins Grant. All the teachers have to do is be willing to go and learn! Opportunity #1- Local/ Within District – Half of the day is spent visiting a program that articulates with their program. The other half of the day is spent with postsecondary instructors to observe the program opportunities available to students who continue their career and technical training in region. Opportunity #2 – Statewide – The day is spent visiting an exemplary program similar to that of the technology education teachers in another school district in Florida. Teachers take a digital camera and record what is learned about the program during their visit. The teachers then share digital pictures and a brief summary of what was learned via e-mail with other technology education teachers in the district.

Key Contact Person:

Doug Wagner
Director
Adult, Career and Technical Education
Manatee County School District
325 Manatee Avenue West
Bradenton, FL 34205
Telephone: 941.708.8770 ext 2227
Email: Mail@DougWagner.com
Website: http://www.ManateeACT.com

Best Practice: *Advisory Councils*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Technology education teachers must remain current, connected, and viable sources for the most up-to-date knowledge and skills. One way to ensure that this is a true statement is to establish program Advisory Councils. The vast majority of the technology education programs in the country do not have formal advisory councils. Manatee County School District has created a successful implementation plan that has transformed 100% of the technology education programs in this district with effective advisory councils that meet on a regular basis with published minutes, assigned tasks, and a follow up communications. Manatee County is sweeping the state with the creation and implementation of these necessary and effective councils. The school district believes this model can be replicated with much success across the country.

Key Contact Person:

Carol Lewis
Coordinator
Career and Technical Education Advisory Councils
Manatee County School District
325 Manatee Avenue West
Bradenton, FL 34205
Telephone: 941.748.4842 ext 137
Email: lewisc@fc.manatee.k12.fl.us

Best Practice: *Systemic Change in an Educational Setting*

Best Practice Nominator: David Greer

Description of Best Practice: When enacting systemic change in an educational setting, it is important to note two key major issues. One, not all participants will have the same "Buy-In" to the project and second, not all participants will have the same expertise, background, and experiences upon which to draw in implementing the new program. The larger the educational setting, the greater the impact these two issues will become. Therefore, it is important to provide a vehicle for change that allows all programs to achieve a level of success. When changing from a traditional industrial arts program to a technology education-based program, one such method is vendor-based, turnkey laboratory implementation. This process should include not only the new program, but a complete renovation of the laboratories as well.

Between 1990 and 1994, the Fort Worth Independent School District implemented a new technology education based program in 14 high schools and 27 middle schools with 76 teachers. In this transformation process, both of the above concerns were taken into consideration. To expedite the implementation process, a decision was made to purchase a turnkey program that provided hardware, curriculum, and extensive teacher training. In addition, teachers were provided extensive pre-service training to prepare them for the transition during the renovations of the laboratories.

Purchase of the new program was evaluated on several levels including technological innovation, ease of use, equipment, curriculum, integration, technical support, teacher evaluations, and references from other school districts. Although one of the programs evaluated was seen as more appropriate for middle schools, it was determined that purchasing the same program for both middle and high schools would provide a stronger support system among the teachers.

With the threat of Y2K in 1999, an opportunity was presented to upgrade the original programs with new computers, equipment, curriculum materials and lab activities. This has helped keep the programs up-to-date and provided an opportunity for teachers to implement a greater breadth and depth of technology to their programs.

Today, the programs have taken on various levels of development. Approximately one half of the original teachers have retired or moved to other positions. The remaining teachers have implemented new and innovative changes to the programs, which reflect their interest and expertise. Newly employed teachers have brought varying levels of expertise including backgrounds in different teaching fields, college training in technology education, and alternative certification. The success, breadth, and depth of their programs reflect much of the same type of understanding and implementation as that of the original teachers. The success of these programs was and still remains in the ongoing in-service and training of the teachers as well as their own innovation and creativity.

Key Contact Person:

David Greer (Retired)
Fort Worth ISD
PO Box 700036
Dallas, TX 75370
Telephone: 817.395.3210
Email: dlgreer@earthlink.net

Best Practice: *Standards-Based Professional Development*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Providing professional development opportunities for technology education teachers is critical to the success of a program. Nationwide, it is estimated that less than one percent of a school district's budget is spent on professional development. The Manatee County School District has put together an initiative entitled No Teacher Left Behind, which is in its 4th year of implementation. The initiative centers on the *Standards for Technological Literacy* (STL). Teachers are paid the in-service rate ($15.00 per hour) to attend a 5 to 7 day training event where a nationally recognized standards specialist facilitates curriculum development based on a new innovative technology. Success has been monumental with teachers developing new innovative standards-based lessons that capture the excitement of the new technologies and engages the students in learning. The school district believes the time-tested procedures for the No Teacher Left Behind workshops can be replicated across the country with the same success the district has realized with the STL.

Key Contact Person:

Doug Wagner
Director
Adult, Career and Technical Education
Manatee County School District
325 Manatee Avenue West
Bradenton, FL 34205
Telephone: 941.708.8770 ext 2227
Email: Mail@DougWagner.com
Website: http://www.ManateeACT.com

Best Practice: *Monthly Support Sessions*

Best Practice Nominator: Steve Shumway

Description of Best Practice: Proponents of effective in-service will tell you that in order for in-service activities to be effective, they need to be meaningful and ongoing. A one-shot approach to in-service cause's teachers to become excited about some new concept but all too often these teachers return to their classroom and are soon inundated with their everyday responsibilities. Unfortunately, the new concepts they learned in the in-service are placed on the back shelf.

Darrell Andelin and Neil Hancey are two district technology coordinators in Utah that have been successful in getting their teachers to endorse a series of monthly in-service activities in which all the technology education teachers in the district meet to help one another, share their expertise, and become professionally active in improving the education in their classroom. New teachers often say that this practice "saved" them their first year. Since classroom teachers are often too busy to develop and direct the in-services, these administrators take the responsibility of organizing the in-service activities. This is a very important concept as coordinators need to be actively involved in the design of in-service activities rather than passive participants if they want in-service activities to be successful. Even though the coordinators take the lead in organizing the in-service activities, they obviously use the expertise of each of the teachers when developing the program. Almost every in-service activity includes some type of make-and-take activity.

Key Contact Persons:

Darrell Andelin
Career Technical Education
Granite School District
2500 S. State Street
Salt Lake City, UT 84115
Telephone: 801.646.4340
Email: darrell.andelin@granite.k12.ut.us

Neil Hancey
Career and Technical Ed Supervisor
Davis School District
45 E. State Street
Farmington, UT 84025
Telephone: 801.402.5112
Email: nhancey@dsdmail.net

Best Practice: *Paid Opportunity for Technology Education Curriculum Development*

Best Practice Nominator: Doug Wagner

Description of Best Practice: If you walk into the majority of the technology education programs across the country, you will find an apparent need for quality standards-based curriculum development; unfortunately, most teachers do not have time to pull something together during the work day. The Manatee County School District has structured a program that gives teachers (individual or group) the opportunity to come together in the summer and write curriculum. Each teacher who accepts the challenge to write curriculum to enhance their subject area is paid for their time (up to $2,500.00). When the curriculum is completed, it is distributed countywide to all technology education teachers. This four year old program has delivered some inspiring examples of what can be done with a little motivation. It is important to continue this means of compensating teachers for completing this kind of work to enhance technology education. This program can be emulated across the country with successful results.

Key Contact Person:

Doug Wagner
Director
Adult, Career and Technical Education
Manatee County School District
325 Manatee Avenue West
Bradenton, FL 34205
Telephone: 941.708.8770 ext 2227
Email: Mail@DougWagner.com
Website: http://www.ManateeACT.com

Classroom Initiatives

Best Practice: *Modifying Assignments for Diverse Learners*

Best Practice Nominator: Marie Hoepfl

Description of Best Practice: Teachers in virtually all classrooms work with students of varying ability levels, including students who have identified learning disabilities or other special needs. Finding effective ways to accommodate those special needs while continuing to address the stated standards and outcomes for a program can be challenging. Unfortunately, many teachers lack the know-how and commitment to do this effectively.

In the technology education program at Ashe County High School, Thelma Kastl has created a wide variety of innovative activities for introducing content to her students. This has included moving beyond the walls of her classroom and into the larger community. For example, Thelma has cultivated relationships with many local businesses and industries. Students have created projects, promotional materials, and research papers that focus on local industries (such as the Christmas tree growing industry that is prominent in their county). Thelma has regularly made use of field trips so that students can see things like "Carowinds [an amusement park] behind the scenes" and the use of remote sensors to monitor traffic flows on a historic viaduct along the nearby Blue Ridge Parkway.

At the most basic level, Thelma recognizes that the students in her classroom have varying learning styles, and for this reason she is always cognizant of the need to expose them to material in a variety of formats. This approach allows the students to "see, hear, and do" material related to the specific concepts being taught. In order to make sure concepts are visited and revisited, Thelma maintains a curriculum matrix so that she can map when and how students learn about and use all content and skill areas contained in the state's course "blueprints" for technology education courses. For many of the activities, Thelma has created a stratified approach that allows students to participate at varying levels of difficulty, without sacrificing content. In other words, different students might create products that vary in their degree of difficulty, but that focus on applying the same skills and knowledge. Students who select the lower degree of difficulty are not penalized. Thelma works with students to help them select which approach they will use, so that no student is prevented from selecting the more ambitious levels of work.

Key Contact Person:

Thelma Kastl
Ashe County High School
184 Campus Drive
West Jefferson, NC 28694
Telephone: 336.246.2400
Email: tkastl@ashe.k12.nc.us

Best Practice: *Increasing Student Achievement through Elementary Technology Education*

Best Practice Nominator: Barry Burke

Description of Best Practice: The Baltimore County Public Schools (BCPS) has piloted the inclusion of elementary design and technology activities at Arbutus Elementary School as part of a National Science Foundation funded project called "Project Update." Design and technology activities were infused into the existing BCPS Essential Curriculum, and teachers attended specialized training for Project Update from The College of New Jersey. The elementary teacher who took the lead on the Design and Technology Team was Regina Wade, who worked with Ron Todd on Project Update to develop the plan. Project Update organizers sought to determine if student scores on state mandated tests would increase if the students applied mathematics and science concepts through hands-on activities. In addition to the elementary technology education activities, teachers looped, or stayed with the student cohort for grades 1-3. Data on student performance on the mandated Maryland School Performance Assessment Program (MSPAP) showed that students who were involved in the Project Update achieved significantly higher on the MSPAP than students in other schools with similar demographics. Areas of improved student achievement scores included mathematics, science and social studies. In addition, when the existing principal left the school, scores on the Grade 3 achievement test decreased. When a new principal was assigned to the school and the Design and Technology Program was reinstituted, scores increased.

As a result of Project Update, teachers are working together to implement a Science and Engineering Fair for Grade 3 students. Students are involved in classroom science and engineering challenges that are hands-on and which are based on the *Standards for Technological Literacy*; yet, the challenges meet state outcomes for mathematics, science, and social studies.

Key Contact Person:

H. Michael Shealey
Supervisor of Technology Education
Baltimore County Public Schools
1946-0 Greenspring Drive

Timonium, MD 21093
Telephone: 410.887.8927
Email: hshealey@comcast.net

Best Practice: *Action Figure Activity*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: Toys? Everyone loves them – little kids, big kids, boys, girls, men, and women. Toys transcend cultures and genders. That's why Curt Reichwein loves to develop toy-based activities for his high school students in *Advanced Mechanical Drawing* or *Introduction to Engineering Design*. In Curt's opinion, these students are "closer to playing with toys than building the space shuttle" and using motivating projects such as these "wins a battle . . . gets me in the door." Plus, it takes a lot of engineering to develop toys and they are the perfect medium for enticing young designers to be creative and innovative. This multifaceted project not only involves students in designing solutions to a problem, but also in thinking about the marketing and production aspects of the products they create. In addition to creating designs, they are writing about them, discussing them, and communicating with others about them – thereby making core subject concepts an integral and fun part of the creative technological design process. In the future, the instructor thinks it would be ideal to output these designs to a 3D printer so students can truly see the end product and more thoroughly complete the design cycle. Unfortunately, the cost of this kind of output device is currently cost prohibitive.

A typical scenario for developing a toy (action figure activity) is as follows. Students are presented with a problem to design and develop a unique action figure with interlocking parts that moves freely and can be assembled or disassembled. The action figure must be doing something (e.g., riding a skateboard, skiing, using a tool) and it must fit within predetermined size constraints. Students are informed that the ideal design would also have interchangeable parts so that the user could manipulate the action figure and change parts on it as desired. Students develop sketches to play around with styling and accessories and then they use solids modeling software (Inventor®) to create their solutions to this problem and develop full-size plans. They also take a screen shot of their designs and incorporate each one into a single PowerPoint® slide. All students' designs are then shared via a slide show and a class critique takes place involving all students in the assessment process. When this project is nearing completion, the instructor then poses the problem of manufacturing the action figures using some type of molding operation. Students are presented with an additional challenge at this point to design a mold frame that could minimally produce two of their action figures in an efficient manner. The instructor purposely poses this question after the figures are designed so that the students' creativity is not stifled because of concerns about how it will be manufactured later.

One website that helped adds inspiration to the action figure design project is www.stikfas.com. Visit the Technology Education program's web site at http://npteched.org/ or http://npteched.org/engineering/index.htm. The latter is a special site geared toward the work this program does through Project Lead the Way.

Key Contact Person:

Curt Reichwein
North Penn High School
Technology Education Department
1340 Valley Forge Road
Lansdale, PA 19446
Telephone: 215.368.9800 ext 460
Email: Reichwec@npenn.org

Best Practice: *Female Student Recruitment*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: One of the areas that Robert Steketee at Cache La Poudre J.H. is most proud of is the number of female students that he has recruited to his program. Four years ago he proposed the idea of an all female technology education class to the district technology coordinator and his principal. Both were very supportive of the idea but at the same time cautious of the legality of a segregated class. He wrote a proposal for the class and contacted the Colorado Department of Education. The legal representative of the Colorado Department of Education, although complimentary of the idea of an all female technology education class, stated that it would not be legal. However, the counsel did suggest that he could develop a course with a name and description that would be attractive to females. This is what he did and for the past three years he has been teaching a class titled "Women in Technology."

Females are under represented in technology education classes today. The reasons have not changed since the evolution of technology education from industrial arts. Some of these reasons for the under representation include feeling of awkwardness in hands-on settings, teasing from the male students in the class, and the feeling of competition from male students.

As our society becomes more dependent on technologically literate people, it is important that all students be exposed to technology education. Robert believes it is his professional responsibility to do whatever he can to provide all students with an environment where they can excel to their full potential. The introduction of the Women in Technology course has removed some of the barriers that were keeping some females from taking his technology education classes. Robert typically has class sizes of 30-35 for the Women in Technology course. One of the benefits that has resulted from the Women in Technology class is that many of the females that enrolled in it go on to enroll in other technology education classes offered at his school.

Key Contact Person:

Robert Steketee
Cache La Poudre JH.
3511 W County Road 54G
PO Box 468
La Porte, CO 80535
Telephone: 970.419.7453
Email: rstekete@psdschools.org

Best Practice: *A Periodic Break from Modules*

Best Practice Nominator: Steve Shumway

Description of Best Practice: With the proliferation of modular laboratories within technology education, the profession's teachers need to consider the benefits and difficulties with this instructional approach and then work collectively toward their effective use. One of the obvious benefits of a modular laboratory is that the students are provided many unique and wonderful learning opportunities (e.g., choice of learning activities, teachers don't need to purchase a complete set of equipment or software as students can rotate among activities). Despite these benefits, many teachers have expressed frustration that something just seemed to be missing in their classrooms. At the beginning of the semester, students seem to be very excited with the choices of modules from which to learn and they like the opportunity afforded them to work individually or in small groups as they rotate from one module to another. Unfortunately, after several months of this type of instruction, the students' excitement for the modules diminishes and motivation and discipline issues seem to intensify. It seemed that the students were burned-out on this type of instruction and even yearned for the teacher to "just teach them something."

One of the technology teachers in a local district decided that a steady diet of any type of instruction was too much. He decided that modular meant more than rotating students through "canned" modules every few days. Modular might also mean allowing students to identify a problem and then use the content available from the modules to apply to a larger designed solution. He started rotating the students among whole-class activities, modular instruction, and small group problem-solving activities and the students' excitement and motivation to learn increased. It wasn't that the modular approach was necessarily bad, but rather that students have an inherent need to be taught with a variety of instructional strategies. Teachers in modular laboratory environments need to consider rotating their students through other types of activities in order to maintain student motivation and excitement for learning.

Key Contact Person:

Brent Boswell
Jordan High School
Jordan School District
95 E Beetdigger Blvd
Sandy, UT 84070
Telephone: 801.256.5500
Email: brent.boswell@jordan.k12.ut.us

Best Practice: Elemen*tary Student Engineers – Building a New Community*

Best Practice Nominator: Gregory Kane

Description of Best Practice: The objective of this eight-month elementary technology education project is to plan, design, and build a three-dimensional model of a new multicultural, inclusive, and ecologically minded community. Grade four and five students from four schools (city, suburban, and rural) participate in this project. Based on job descriptions, students apply for membership on one of the four interdistrict Expert Teams: Transportation, Utilities, Construction, and Planning and Zoning. These Expert Teams meet and work together five times during the eight-month period. A School Group formed at each of the four elementary schools also meets and works together at least once a month. When not working together, the communication between Expert Team members and School Groups is via email and web-cam. Communication about the project with parents and other school system staff is by newsletter. This project is facilitated by volunteer school system personnel, city/town and engineer consultants, technology education college students under the supervision of their college professor, and high school students.

The project seeks is to educate students about the infrastructure of communities by using computer technology and the technology education design process. It also focuses on the integration of math, language arts, science, and social studies as well as group dynamics, problem solving, and decision making skills. The goals are to have elementary students from four different schools work together to (a) create a computer-generated map of a new community; (b) build three-dimensional model structures (buildings, bridges, stop lights/signs, etc.) for designated locations on the map; and (c) develop a multimedia presentation to persuade people to live in the new community.

Every student works with two groups of students – their interdistrict Expert Team and their School Group. Each Expert Team is given a job description, an essential question to answer, and a topographical map of the imaginary community with information regarding the projected population, neighboring communities, and community expectations. During the first two interdistrict sessions, students work with city/town consultants and teachers to determine the types and locations of community buildings, recreational facilities, transportation, services, and utilities required to meet the needs of a community with a population of 12,000 - 15,000 people. (The discussions and decisions incorporate the research and investigation done by students in their School Groups. The considerations, restrictions, and decisions are guided by student questions and consultant expertise. The high school students act as scribes for these meetings while recording the important information, discussions, and decisions made by each Expert Team.) The key negotiations are with the Planning and Zoning Team to determine the types, numbers, and locations of the municipal buildings, the modes/location of transportation, the types/location of utilities, and the general land use in the community.

After the second interdistrict session, each School Group is given a computer-generated map of one of the quadrants of the community which includes all of the agreed upon community structures. This quadrant is the neighborhood in the community that the School Group must develop. Students vote via email and a name is selected for the new community. During the next two interdistrict sessions, the Expert Teams are given design challenges and begin to create and construct the community's buildings, bridges, utility poles, etc. with the guidance of the teachers, consultants, college professor and students, and the high school students. The School Groups are issued building permits based on their quadrant maps and they begin the creation and construction of the housing and businesses in their neighborhoods using a computer program. The digital quadrant maps are enlarged (16x) by the town GIS technician and one large community map is assembled and glued to cardboard backing. The structures are placed on the map as they are completed by the Expert Teams and School Groups. The final interdistrict session is a celebration of learning and new friendships. The completed map is displayed. Expert Team members talk about their contributions to the map and reflect on what they learned. The Planning and Zoning Team show their multimedia presentation about the new community.

Key Contact Person:

Diane Novak
Principal
Highland Park Elementary School
397 Porter Street
Manchester, CT 06040
Telephone: 860.647.3430
Email: dsnovak@aol.com
School Website: http://art-smart.ci.manchester.ct.us/hi/highland.html

Best Practice: *Contextual Learning*

Best Practice Nominator: Philip A. Reed

Description of Best Practice: Elementary teachers have an enormous amount of responsibility for planning and grading multiple subjects. Technology education at this level is often viewed one of two ways – either as another subject area to teach or as a unifier that brings relevance to other subjects. The second method of teaching technology education is a best practice for elementary teachers because it makes learning relevant for children. Additionally, the use of contextual learning could be used as a best practice for secondary teachers. The current focus on accountability has secondary technology teachers identifying their role in standardized testing and school accountability procedures. Elementary teachers that have successfully utilized contextual learning can help in this task by providing materials and guidance. Linda Harpine, for example, is a retired elementary teacher who now shares her experience of contextual learning with all levels of technology educators. Through state and national presentations, Linda demonstrates how she integrates technological content into language, science, mathematics, and social science lessons. She was instrumental in establishing the Virginia Children's Engineering Council and for organizing their annual convention (see http://www.vtea.org/ESTE/). Additionally, Linda is the co-founder of Children's Engineering Educators, which is a company that writes and consults on contextual learning practice at the elementary school level.

The value of contextual learning is regarded very highly by the National Science Foundation as seen in the significant amount of funding being provided for Science, Technology, Engineering, and Mathematics (STEM) initiatives. Incorporating these best practices into secondary programs will surely help identify the role of technology education.

Key Contact Person:

Linda E. Harpine
7126 Porch Swing Lane
Dayton, VA 22821
Telephone: 540.828.3278
Email: Lharpine@cs.com

Best Practice: *Green Technology*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: Students at Greencastle Middle School in Greencastle, Indiana are presented with a problem to create a piece of furniture made entirely from recycled and "unorthodox" items. Working in small teams, students must incorporate at least three different materials to make their "new" piece of furniture. Since students are not allowed to purchase materials, their solution must be made entirely from scrounged materials. As a result of this problem, students have created a wide assortment of furniture pieces from a variety of recycled items such as tire rims, old tarps, foam insulation, and broken products. For example, one team recently made a fold-up bed from old closet doors. This activity has received much support from the school's administration and has also received positive public relations in local newspapers.

Students begin the unit by conducting intensive research about recycling. During this process, they learn about how important it is to recycle and where some of the greatest problems in recycling occur including furniture recycling. The process helps to develop in them an appreciation for recycling and it helps to motivate them to be creative in their solution to the problem. Students collect materials and bring them to the "Green Technology" classroom/laboratory where they design, build, and evaluate their solutions over a period of several weeks. During the course of completing the unit, student teams are expected to develop their concept, build it using tools/machines in the laboratory, and defend their design.

Through this activity, students begin to ask a lot of good questions about design and recycling, as well as technical questions about how to combine the materials using tools and machines. They learn to become more independent because of the open-ended nature of the problem and the need for them to show initiative in identifying and locating the materials that they need to solve the problem. Since they work in small groups, they must also develop teamwork skills in order to have a successful solution to the problem. Furthermore, this activity helps them to understand and interact with technology in their world and see that they can be part of the solution to the recycling problem by being creative, technological problem-solvers.

Key Contact Person:

Eric Baird
Greencastle Middle School
400 Percy L. Julian Dr.
Greencastle, IN 46135
Telephone: 765.653.9774 ext 142
Email: ebaird@greencastle.k12.in.us

Best Practice: *Technological Problem Solving*

Best Practice Nominator: Vincent Childress

Description of Best Practice: Teaching students to become problem solvers is at the heart of the purpose of technology education. Kim Kulawik helps his students become better problem solvers each school day. Sometimes his students are engineering and sometimes they are just problem solving, but they are usually trying to solve real-world problems through the application of and/or design of technology. Kulawik's students follow a problem-solving model from the North Carolina state curriculum. Students design, test, and redesign their solutions to improve them.

The following link is to an article about Kulawik's technology education program:
http://www.teachercentral.org/trailhtml/1101/nctg.htm

The following link is to the North Carolina state curriculum for technology education:

http://www.mgsd.k12.nc.us/mms/Exploring%20Technology%20Systems.htm

For Kulawik's curriculum, download Exploring Technology:
http://www.dpi.state.nc.us/workforce_development/technology/curriculum.html

Key Contact Person:

Kim Kulawik
Mooresville Middle School
160 South Magnolia Avenue
Mooresville, NC 28115-4500
Telephone: 704.663.3841
Email: kimkulawik@mgsd.k12.nc.us

Best Practice: *Mars Mission Project*

Best Practice Nominator: Kenneth Starkman

Description of Best Practice: The objective of the Mars Mission Project is to introduce middle school students to a simulated mission to the planet Mars. The project incorporates curriculum standards from several disciplines, requires parental involvement, students make a mission presentation to the school board, and the activity receives local media attention. It is based on the exploratory philosophy of middle school technology education with an emphasis on student creativity, problem solving, time management, teamwork and many other social and work place skills important to all adolescent learners.

The Mars Mission Project is a culminating activity designed around a space theme. Students spend several weeks studying the elements of space technology, exploration, and habitation. Embedded within the daily work the students get a good look at current developments including direct Internet connections with NASA and other space industries and organizations with interest in space education. In the pre-mission phase of the activity, students learn how astronauts are trained, what they eat, how they go to the bathroom, how they navigate their spaceship, how biofeedback works to monitor the health of individuals in space, physical science laws, and much more.

Students who participate in the Mars Mission Project must apply to be an astronaut, scientist, mission control engineer, etc. The students are selected from several technology classes to perform a job as part of the mission. Some of the students remain in the classroom while others enter a room that simulates their spaceship. Once the spaceship reaches Mars, the astronauts establish a colony. Once the colony is established, students conduct the planned experiments and send data back to earth where it is recorded and analyzed. Meal consumption, blood pressure, and pulse are measured, and other biological measurements are taken on each of the astronauts. The colony itself is a series of dome tents set up outside the school with video feed to mission control. Robots are used to assist the astronauts in completing their mission.

Parents of the students must volunteer to assist with the mission because it takes place over a weekend. Parents observe the activity in a series of shifts and help monitor the condition of the astronauts. The astronauts spend two nights on the surface of Mars. Local newspapers are also invited into the school to take pictures and interview the students and parents.

Jefferson Middle School started doing space missions several years ago inside a space shuttle simulator constructed in the old industrial arts' wood shop. Since the days of the shuttle missions, a new school was constructed complete with a modern technology classroom and laboratory. Today, the space shuttle is gone but the school has progressed with a more modern space program with the ability to reach Mars.

Key Contact Person:

Richard Herbst
Jefferson Middle School
501 South Taft Avenue
Jefferson, WI 53549
Telephone: 920.675.1300
Email: herbstr@jefferson.k12.wi.us

Best Practice: *Just-In-Time Instruction (DVD)*

Best Practice Nominator: Steve Shumway

Description of Best Practice: In his teaching situation, Gary Roberts at Wasatch High School has students with diverse ability levels working simultaneously on a multitude of activities. This creates a classroom management problem. How can he provide instruction to students with diverse abilities working on so many different activities? Additionally, Gary noticed that if he stopped the class and provided instruction on an entire process that the students needed to complete, the students who were at that point in the activity listened intently while those not at that point didn't pay attention and the information had to be essentially re-taught when the students were ready for it. To overcome this problem, Gary decided to implement his version of Just-In-Time instruction. Gary videotaped his instructional demonstrations, including how to perform computer software operations, and put them on a DVD that the students can use when they are ready to advance in an activity. The real benefit has been for the advanced students. These students seem to have the knowledge and motivation necessary to use this type of learning and leave more opportunities for Gary to spend time giving direct instruction to the students that are struggling. Gary has distributed the DVDs to other teachers in the state and these teachers are using them to supplement (not substitute) their teaching.

Key Contact Person:

Gary Roberts
Career and Technical Education
Wasatch High School
64 E 600 S
Heber City, UT 84032
Telephone: 435.654.0640
Email: gary.roberts@wasatch.edu

Best Practice: *Innovative Curriculum*

Best Practice Nominator: David Greer

Description of Best Practice: Highland Park is a small high school with a large program. The school has 430 students in K-12 grades with 220 students in the high school. There are 130 of the 220 students enrolled in the technology education program. The teacher offers a varied curriculum based on a vendor-based (Depco) curriculum laboratory setting.

The key to the success of this program is the teacher. Although originally reluctant and even resistant to change, the teacher is now one of the most innovative educators in the Texas and has been recognized as an outstanding teacher by his school and his regional professional association. He has taken each of the vendor produced activities and added extension activities to each. In addition, he continues to write new activities in such areas a linier video editing, automation, and computer integrated manufacturing.

The teacher has a strong Technology Student Association chapter organization. In state competition, his students have consistently won the overall point's award for 1A classified schools as well as being a contender for the highest overall point's award.

Most recently, he has been recruited by the local community college to help in the development and articulation of a new program. Bell Helicopter has expanded its production in the area and has expressed a need for a well-trained workforce. The newly developed program will focus on a 5-station CIM laboratory which will be located at a nearby community college. The high school students will be able to develop their programs in a virtual environment and then go to the community college to run the programs in an actual environment.

Key Contact Person:

Earl Feemster
Highland Park High School
Highland Park ISD
West Highway 60

Amarillo, TX 79120
Telephone: 806.322.3737
Email: elfclf@cox.net

Best Practice: *Media Spin-offs*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: What do *Mission Impossible II*, *Apollo 13*, and the *World Series* have in common? These are three of the many ways that this technology education teacher in Farmingdale, New Jersey kicks off a new unit. She creates design challenges related to movies, sporting events, and television shows. And, to make it even more interesting, she even builds the testing apparatuses that students need to test their solutions. For example, when students study the *World Series of Mechanisms* each year (to coincide with baseball's World Series), they are challenged to design and make a mechanical baseball player (powered by mechanisms) that are capable of hitting a ping pong ball off a tee. Students select a player (from the current teams in the World Series) and design their mechanical player accordingly (e.g., left handed pitcher). Students use all kinds of modeling materials (e.g., balsa, basswood, bobbins, springs, screws) and basic tools (e.g., drill press, hand tools) to construct their players. The students then test their players on a baseball field constructed by the teacher that closely approximates the *World Series* field for that season. (Yes, she has built several fields.) Interdisciplinary skills are enhanced when students also learn to calculate batting averages (math), reflect in writing about their design process, and more. As another example, *Mission Impossible II* (a biological terrorism movie) was the basis of another design challenge that required students to fetch the deadly disease antiserum from a tower that could only be accessed through louvers on the building's roof. (In the movie, Tom Cruise did this using a helicopter.) The teacher built a replica of the building with blinds serving as louvers and students were challenged to find a way to go inside the tower through the louvers (set on timer to open/close every 45 seconds) to steal back the antiserum (an egg). Can you sense the excitement?

This "media spin-off" idea first occurred to this teacher when she saw the *Apollo 13* movie and fell in love with the example portrayed in that movie of astronauts solving a complex problem with limited materials that they had with them in space. This teacher regularly uses media as the springboard to new design and problem solving projects and she shows media clips to help build students' excitement for the problem and to help set the stage for the challenge. She does extra research for every one of these to learn whatever she can about the technology, science, math, history, and anything else that can help her make the unit more interesting, realistic, interdisciplinary, and relevant.

What high school student isn't attracted to the big screen, television, or sports? Media connections not only provide a creative backdrop for technology education design challenges, but they also put the design challenges in a context that is relevant and meaningful to high school students. Through these learning experiences, students see how technology relates to their personal interests and lives. They discover that technological problems have more than one solution and that technology impacts our lives in many ways. Sherry Roses, the innovative high school teacher who fabricates these challenges, can see how this approach to technology education is making a difference for her students. She considers one of her greatest achievements the fact that 18 of her students have gone to become technology education teachers in the past 20 years. Two of these former students have returned to become her colleagues. That accomplishment alone says a lot about the best practices going on in her technology education classroom/laboratory.

Key Contact Person:

Sherry Roses
Howell High School
405 Squankum-Yellowbrook Rd.
Farmingdale, NJ 07727
Telephone: 732.919.2131
Email: sroses1220@aol.com
Website: http://www.frhsd.com/HOWELL_HS/Ms_Roses.htm

Best Practice: *Bridging Research and Practice*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: Robert Steketee, a classroom technology education teacher at Cache La Poudre JH, develops lessons and projects that have each student or a pair of students design and build individual projects that are a part of a larger group project. This approach is consonant with the research recommendations from the cognitive sciences on distributed expertise and design experiments in the classroom.

Robert has developed project-based lessons where each student is responsible for a part or portion of a large project. One of the lessons, for example, is the creation of a model of the International Space Station (ISS). Robert has had as many as 75 students engaged from three different classes working on one model of the ISS. On this project each pair of students is assigned a part or module of the ISS as their contribution to the project. They are responsible for researching the component they are assigned, developing a working set of drawings, and building a replica or scale model of the component. A list is posted of all the teams and their parts so that the students know who has mating parts to their part Students are required to communicate with each other, often with team members from other classes, to discuss how they will get their parts to fit and articulate properly. The procedure that is followed underscores the importance of building good communication skills among the students in the completion of a large project in a technologically rich environment.

Another example of using distributed expertise in the classroom is the development of planned communities where each student is responsible for developing a plot of land within the community. Students are given a set of conveniences and a topographical map of their plot and the community as a whole. They use this information to design a structure and landscape their plot that is in compliance with the community's codes and master plan. Each student is challenged to build a model of their plot and then join it together with the other students' plots to form the community. As in the ISS project, communication is an important component to success.

These types of projects incorporate many important concepts including design, communication, materials exploration, research, fabrication (design build), and interpersonal skills. What Robert indicates that he likes the most is that he gets 100% participation from the students. The students want these projects to look nice because they have a personal investment in their learned design skills; furthermore, their work is displayed in the main entry corridor to the school. The students encourage their classmates to produce a quality product and help each other so that the projects are successfully executed.

Key Contact Person:

Robert Steketee
Cache La Poudre JH
3511 W County Road 54G
PO Box 468
La Porte, CO 80535
Telephone 970.419.7453
Email: rstekete@psdschools.org

Best Practice: *Technology Teacher Educators and Public School Experience*

Best Practice Nominator: Chris Merrill

Description of Best Practice: There are a number of technology teacher educators who prepare teachers for public school technology education programs. However, most of these teacher educators have little or no public school experience or they have been removed from the classroom for an extended period of time. Technology teacher educators need to have spent time teaching in the public schools before entering the teacher preparation level. Once at the teacher preparation level, technology teacher educators need to continue their work in the public schools by observing, supervising student teachers, interacting with students, and communicating with teachers on a routine basis. If technology teacher educators have multiple years of successful teaching at the public school level, they will have a better grasp of the programmatic issues facing today's teachers and students. Steve Moorhead at Bowling Green State University is an exemplary example of a teacher educator with multiple years of successful teaching at the public school level.

Key Contact Person:

Steve Moorhead
Bowling Green State University
College of Technology
Bowling Green, OH 43403-0280
Telephone: 419.372.8438
Email: SWM1DTE@aol.com; waynemo@bgnet.bgsu.edu

Best Practice: *Exploring Alternative Energy Production*

Best Practice Nominator: Gregory Kane

Description of Best Practice: The purpose of this technology education course at South Windsor High School in Connecticut is to explore how society will meet its future energy needs. The course uses textbooks, articles, and a series of experiments to explain a variety of energy related technologies.

The goal is to provide students with the opportunity to explore energy production and distribution systems in order to develop an appreciation for the social, economic, and environmental impacts of these technologies. Students work with energy conversion systems that are environmentally friendly and renewable in an effort to inform them of potential solutions that can meet our future energy needs. In the process students identify academic strengths and weaknesses that relate to the design professions. The course provides each student with the knowledge and skills necessary to use technology as a creative tool.

This course provides students with the opportunity to explore energy and electrical power production. Students first explore our current energy resources and production systems through selected readings and discussion. They then conduct an energy audit of their homes and develop an appreciation for how much energy their family consumes. They also examine what it costs their family to maintain their current level of energy consumption. The students then cost-out an alternative energy system that could provide an adequate amount of power to their homes. Finally, the students study the environmental impacts associated with energy production systems. During this portion of the course, they explore Fuel Cell Power Plants and track power production data from an on site UTC Fuel Cells PC 25 Power Plant.

Students learn how fuel cells use chemical processes to produce electricity by examining and testing a variety of models that use various fuels to produce electricity. They perform experiments with hydrogen/oxygen fuel cells and methanol fuel cells and they graph performance data and produce reports that demonstrate their understanding of this technology.

The culminating experience for the students is the design and production of a small scale fuel cell. Students reverse engineer a single cell fuel cell to examine all of the components and develop ideas for their design. Students then use PTC Pro/Desktop computer aided design software to develop a design as a group project. Each student is responsible for some component of the fuel cell and a 3D CAD model and engineering drawings of the design are created. Components are tested in CAD to insure that they fit together and then machined on a CNC machine to produce the final components. The finished prototype is then tested with the electrolyser and meters used in previous experiments to test the commercially manufactured fuel cells. Students compare their results to those of the commercially produced fuel cell and produce a final presentation that documents the design and production process.

Key Contact Person:

Allan Mothersele
South Windsor High School
161 Nevers Road
South Windsor, CT 06074
Telephone: 860.648.5000
Email: amothersele@swindsor.k12.ct.us
School Website: http://www.swindsor.k12.ct.us/Highschool/index.htm#

Best Practice: *Energy Transformation Devices*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: Students are asked to design an energy transformation device that is contained within 2' x 2' footprint and created entirely from recycled materials. The device must incorporate all six simple machines to transfer motion from the input to the output. The unique aspect of this device, however, is that each team's design must integrate with the next team's design so that all the energy transformation devices can be combined into one large energy transformation device (transferring energy from the first device to the last device in consecutive order). This engineering design activity is adapted from one developed and promoted by *Project Lead the Way* and known as the SMET device (using Science, Math, Engineering, and Technology to create a Simple Machine Energy Transformation Device).

Students' designs must be developed on paper prior to beginning construction, with the design scanned into the computer and serving as the "legally binding design document." Students are penalized if they vary the design without first filing an engineering design change notice. Throughout this design activity, students must keep a journal and document their design process, including all necessary calculations pertaining to the problem (e.g., force, weight, distance). Students are encouraged to design and build appealing solutions (e.g., no tape allowed) that solve the problem in the most creative manner. They mostly use hand tools, but they have access to other specialty tools to enhance their design (e.g., a laser cutter to engrave or cut parts).

Through this activity, students learn about energy transformations, kinetic and potential energy, mechanisms, and more. This is an exciting challenge for students and one that helps them begin to value the importance of planning ahead and relying upon scientific and mathematical information or research to inform design solutions. Students get a sense of how products are designed in the real world and the importance of accuracy in transforming designs from paper to final product. Students often refer to this Rube Goldberg influenced idea as the "coolest project!"

Key Contact Person:

Michael Voicheck
North Penn High School
Technology Education Department
1340 Valley Forge Road
Lansdale, PA 19446
Telephone: 215.368.9800 ext 460
Email: VoicheMG@npenn.org

Best Practice: *Structuring Individual Accountability*

Best Practice Nominator: Steve Shumway

Description of Best Practice: With the release of the *Standards for Technological Literacy: Content for the Study of Technology*, it became evident that students enrolled in technology education classes would be involved in cooperative group activities in which they would be asked to work as an "engineering" team to problem-solve, conduct research, and design and develop technological devices as solutions to various problems. Historically, while many technology education teachers involve their students in cooperative group opportunities, they are often discouraged by the lack of actual cooperation among the students. Proponents of cooperative learning believe that simply placing students in groups and asking them to complete an activity does not mean that the students will work cooperatively or that they will even know how to cooperate. Furthermore, they believe that cooperative learning can only be successful when there is a common group goal and there is individual accountability of group members. In other words, each member of the group must understand and perform their specific responsibility in order for the team to be successful. One of the main problems with involving high school students in cooperative activities is to determine if individual accountability needs to be formally structured into an activity or whether these students are sufficiently mature to establish individual accountability through informal means.

One method that has been found to be successful when formally structuring individual accountability is to use team contracts. With team contracts, students working in design groups must first determine the individual responsibilities that must performed in order to successfully complete the design. The students then assign/accept these specific responsibilities and then sign a contract. In addition, the teacher reviews the responsibilities with the students and then signs the contract. While students are working on the project, the teacher periodically checks with the groups to see how each student is performing relative to their responsibilities.

Paul Reynolds, a technology teacher at Bingham High School in Utah, conducted a study with his students and found that when students worked in groups where individual accountability had been formally structured into the activity (i.e., team contracts), the students had higher levels of group success and individual learning, and more positive perceptions of other members of the group.

Key Contact Persons:

Paul Reynolds
Technology Teacher
Bingham High School
2200 W 10400 S
South Jordan, UT 84095
Telephone: 801.256.5100

Steve Shumway
Technology Teacher Education
Brigham Young University
Provo, UT 84602
Telephone: 801.422.6496
Email: Steve_shumway@byu.edu

Best Practice: *Classroom Teachers Who Publish*

Best Practice Nominator: Philip A. Reed

Description of Best Practice: Publications by classroom teachers are vital to any education field because teachers are always interacting with students and can provide invaluable feedback. However, editors and individuals on editorial boards consistently say that many teachers do not publish because they are not confident with their writing abilities or do not see publishing as a rewarding professional experience. Additionally, many teachers do not realize that publications often count toward recertification points. These issues can be overcome by showing teachers what works. For example, by starting in state publications and working toward more prestigious publications, teachers can build their writing skills and self-confidence. Stephen Baird regularly publishes articles in *The Technology Teacher* (TTT) and was recently appointed to the TTT editorial board. He has found publishing very personally and professionally rewarding and has developed a close tie between his writing and teaching. By making this link, he is in a great position to help other teachers share their work through publications.

Key Contact Person:

Stephen L. Baird
709 Virginia Avenue
Virginia Beach, VA 23451

Telephone: 757.425.5811
Email: sbaird3@cox.net

Best Practice: *Enhancing the Instructional Program*

Best Practice Nominator: Marie Hoepfl

Description of Best Practice: The competitive events that are part of the Technology Student Association (TSA) program represent powerful instructional activities that can be used to supplement an instructional program, even without student participation in the TSA competitions. With skillful blending of TSA activities in the classroom, however, it is possible to accomplish two goals: (a) incorporate powerful learning activities that reinforce the conceptual understandings contained in the course of study, and (b) prepare students for successful participation in TSA events.

Kim Kulawik's middle school students at Mooresville Middle School have participated in regional, state, and national TSA conferences for many years. The display case outside his classroom is full of trophies and it bears testimony to the students' success at these events. More important than trophies, however, is the way Kim has used these activities as learning opportunities. For example, one unit of instruction in Kim's classroom focuses on "simple and motorized machines." In this unit, students learn fundamentals of levers, gears, pulleys, and wheels and axles, and they go through a various exercises that allow them to experience these simple machines in motorized and non-motorized applications. Some of the students then make use of this and other knowledge in the design, creation, and testing of motorized vehicles that will be part of the "Transportation Challenge" competition for the middle grades at a TSA conference. In the process, students experiment with different gear configurations, maximizing their design for the particular challenge presented for that year (e.g., climbing ability, speed, etc.). They experiment with the use of various materials for constructing the vehicle's body and wheel coverings. This activity challenges the students to find materials that have the best strength, traction, and other characteristics. The goal is not winning the event, per se, but applying knowledge of processes, tools, and materials to find the best solution to this particular challenge.

The Transportation Challenge is just one example of how TSA events can be used to provide what might be called "authentic" contexts for concept learning. Over the years Kim has used a variety of structural testing challenges with his students to help them understand the principles of compression, tension, triangulation, etc. One great apparatus he employs is a handmade structures tester that provides a very graphic illustration of the principle of leverage (as opposed to the more "black box" nature of the vendor-distributed structure testing devices). Another tool that Kim uses with his students is to videotape structure testing, and then analyze the footage frame by frame with students to evaluate the cause of structure failure. The recent completion of the TechKnow materials by Richard Peterson and colleagues at North Carolina State University (Kim was one of the writing team members for this project) will help to bring the learning potential of TSA activities to a broader audience.

Key Contact Person:

Kim Kulawik
Mooresville Middle School
160 S. Magnolia Avenue
Mooresville, NC 28115
Telephone: 704.663.3841
Email: kimkulawik@mgsd.k12.nc.us

Best Practice: *Cooperative and Context Based Learning Environments*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: Chip Miller and the Summit High School Technology and Pre Engineering Department have teamed with other teachers in the high school from the content areas of mathematics, science, and language arts to create a Natural Resources Academy. The academy serves to frame technology classes in GIS/GPS & Engineering Surveying with integrated studies in mathematics, statistics and probability, advanced field biology, literature, and technical writing, through context based projects and applied cross discipline integration.

Chip believes that when instruction is framed in context or work-based relationships, students demonstrate more interest in what is being learned. This method of instruction relies heavily on the use of instructional tools and projects in teaching Problem-Based Learning (PBL). Problem-based learning (PBL) is an educational approach that challenges students to "learn to learn." Students work cooperatively in groups to seek solutions to real-world problems and more importantly, to develop skills to become self-directed learners. Here, the goal of problem-based learning is viewed as learning for capability rather than learning for the sake of acquiring knowledge. PBL is unique in its integral emphasis on core content along with problem solving. Within the context of reading in the PBL classroom, learning thus becomes much more than the process of mere knowledge seeking. Students develop critical thinking abilities by constantly relating what they read to what they want to do with the information. They question the writer's assumptions and analyze information presented, all within the context of finding answers to "What can I do with this information?" and "What does understanding this mean to me?" This digest discusses some of the challenges in learning that students face, and identifies web resources that teachers can use to support student learning.

Students naturally become aware of the careers associated with the diverse subject matter. Through "engineering" the teaching and learning environment to optimize student engagement, inquiry, questioning, and practice using technology, Chip and his colleagues have modeled a cooperative contextual learning environment that is grounded in authentic contexts.

Key Contact Persons:

Lemuel "Chip" Miller, DTE, Technology Education
Peggy Miller, Science Education
Mark McGarigal & Brenda Maholland, Language Arts.
Summit High School
Bend – La Pine School District
2304 Clearwater Drive
Bend, OR 97701
Telephone: 541.322.3204
Email: lemiller@bend.k12.or.us

Best Practice: *"Egg" Citing Vehicle Challenge*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: Eighth grade students get excited when it's time to solve a real-world problem and begin the "Egg"citing vehicle design challenge in technology education at Fleetwood Middle School in Fleetwood, Pennsylvania. This 4-6 day challenge requires students to design and construct a vehicle that can withstand a frontal impact from an oncoming vehicle (the instructor's remote control vehicle). A single egg, serving as the vehicle's passenger, must survive the crash unharmed. The design brief includes several well devised criteria and constraints. For example, all vehicle frames must be constructed of K'NEX® components which ensure that students can design and build within a short time frame. Other materials are also allowed to be used in the design vehicle's safety features. The design brief requires students to base their solutions on research and it even specifies that the egg passenger must have a full 180 degree field of vision out the front and sides of the vehicle. Most importantly, students must document their entire problem-solving process with text and pictures (scanned sketches and digital photos of the process) that are neatly and creatively compiled in a PowerPoint® presentation. Students work in teams of 5-6 and divide responsibilities in order to ensure getting all the work done on schedule.

Middle school students can relate to car accidents. They hear about them on the news and see pictures of them on television and in the newspaper. And, they have been required to wear restraints themselves while traveling in automobiles since birth. These students are also just a few years away from driving themselves so this is a great time to get them thinking more seriously about vehicle safety. Before solving this problem, however, students are required to conduct research about vehicle safety and record their information on teacher-prepared handouts that guide the research process by posing questions about seat belts, air bags, federal vehicle safety standards, crash tests, and more. Students soon realize that the engineering that goes into vehicle safety is a never-ending process that has been pursued from many angles for decades.

This activity provides students with the opportunity to address a wide range of standards in a very short time period. While technology education standards are emphasized (e.g., technological problem-solving, systems), there are clear links to other standards as well including science (Newton's laws related to force and mass) and computer technology (PowerPoint® and input/output devices). In addition, the activity guidelines are posted on the instructor's website which makes the project information accessible to students and parents alike from home. The teacher uses this activity at the conclusion of a course primarily focused on drafting and design in a unit on models, mockups, and prototypes. The clear focus on using and documenting the technological design process and the interesting nature of the problem, however, make this activity especially worthwhile in any middle school technology education class.

Key Contact Person:

Jared Bitting
Fleetwood Middle School
407 N. Richmond St.
Fleetwood, PA 19522
Telephone: 610.944.7634
Email: fasdte@ptdprolog.net
Website: http://www.fleetwoodasd.k12.pa.us/fms/staff/jbitting/index.html

Best Practice: *International Design*

Best Practice Nominator: Kenneth Starkman

Description of Best Practice: The world is getting to be a much more diverse and more competitive place. Economies are converging and our future generations of citizens must be prepared to interact and do business with persons of other cultures, regardless of their geographical location in the world. In order to address this challenge, Steve Johnston at Logan High School in La Crosse, Wisconsin developed an international design unit. The objective of the unit is for Logan High School students to interact with their peers in others countries in the design of a bridge that spans a given obstacle.

This design activity focuses on a group of technology education teachers and students in the United States, Canada, and Japan who work collaboratively to complete a bridge building activity. The technology education instructors communicated via email in the design of an activity that required their students to communicate with each other in order to design bridges that would span an obstacle even when that obstacle was located thousands of miles away.

Students at La Crosse Logan High School selected the Mississippi River as their obstacle and proceeded to develop a presentation that was given to the students in Japan and Canada about the river and why they needed a bridge to cross it. The students in Canada and Japan selected similar obstacles and presented to the partnering schools their case studies for a bridge in each of their communities.

The students were not provided much information in advance about the specific bridge. Instead, they had to take their knowledge about bridge building and apply it to ask the right questions. Some of the questions from the Japanese students inquiring about the Mississippi River bridge included the following:

1. How wide is the river where the bridge will be constructed?
2. What are the soil conditions?
3. What is the topography?
4. What are the vehicle traffic conditions?
5. What are the pedestrian traffic conditions?
6. How deep is the water?
7. What is the topography at the bottom of the Mississippi River at the crossing point?
8. What type of traffic navigates the Mississippi River?

The students from Canada and La Crosse ask similar questions of their partners. All of the communication was done either on the Internet using email or through regular postal service.

Each country's students had to develop and present their drawings and models (solutions) to the students in the other countries. The limitations of the communication tools made exchanging information challenging at times. Overall, there was great success to the program. Preparation was the key element to this activity. The partners have tried to collaborate on other projects but the planning time to get a new project off the ground has been a limiting factor.

Key Contact Person:

Steve Johnston
Technology & Engineering Teacher
Logan High School
1500 Ranger Drive
La Crosse, WI 54603-2700
Telephone: 608.789.7700
Email: johnston@mwt.net

Best Practice: *National Board Certification*

Best Practice Nominator: Philip A. Reed

Description of Best Practice: Until recently, National Board for Professional Teaching Standards (NBPTS) certification was not available to any area classified under career and technical education (CTE). However, these areas, including technology education, are now open for teachers pursuing National Board certification. The certification process is very long and demanding but there are technology teachers who are certified (Steve Portz) or are seeking certification (Stephen Baird). The mentoring requirement for National Board certification makes this a best practice that can easily be passed on to other classroom teachers. The advantages for a teacher to achieve National Board certification vary from state to state. Many states help pay the certification fee as well as offer annual stipends for teachers that maintain their certification. Additionally, renewal points toward a state teaching license and teaching license reciprocity are two widely used rewards. To learn more about the application process and the benefits for obtaining National Board certification, visit the NBPTS website: http://www.nbpts.org/index.cfm.

Key Contact Persons:

Stephen L. Baird
709 Virginia Avenue
Virginia Beach, VA 23451
Telephone: 757.425.5811
Email: sbaird3@cox.net

Stephen M. Portz
Space Coast High School
6150 Banyan St.
Cocoa, FL 32927
Telephone: 321.638.0750
Email: portzs@brevard.k12.fl.us

Best Practice: *Project-Based Design and Engineering Curriculum*

Best Practice Nominator: Gregory Kane

Description of Best Practice: The objective of this long-term project is to involve advanced technology education students in a true engineering project and not just a mimicking activity. This project-based activity has all students responsible to each other and the success of the project, not just to the teacher. Every student becomes responsible to teach their peers about information they have researched on an as needed basis to allow the project to progress. The teacher truly becomes the facilitator with the students learning and researching appropriate information in their fields of responsibility. The teacher learns along with the students and is not responsible for all the answers but is there to guide the process. Students' research includes web-based searches, telephone inquires, email contacts, and mentors in the field. Every student in the class becomes valuable for their specific abilities. The mechanical and electrical engineers are as important to the project as the fabricators and machinists. Mutual respect develops in a heterogeneous class. Students not only take ownership of the project, but also become responsible for their own education.

Students are waiting at the classroom door in the morning for the teacher to get there so that they can start working before school. Students work during free periods and well after school ends so that they will be ready for the next class day. If students approach the teacher with a technical question, the teacher points to the phone and tells the student to find the answer. Students take courses at the local community college at night for advanced CAD training so that they can get their 3-D drawing of the frame they designed to rotate on the program's website. Students conduct statistical analyses in order to determine at what speed a car gets its best efficiency. Students attend an international fuel cell conference in order to see and report to their peers the new innovations in the field. This alternative energy topic allows for class discussions about pollution, world politics, national debt, and global economics. This is the students' future. Class interest is very high. These are only some of the positive things that can happen when students are given the freedom to create.

The school is in the second year of a 3-year project. The first year's goals were achieved with a working mule. (A mule is a test bed for analyzing the compatibility and performance of mated components.) The mule consisted of an old go-cart frame that used a 1.2KW Ballard fuel cell to propel it to 27mph. Phase II is progressing nicely with a student designed and fabricated aluminum frame with major changes to the electrical system. Ergonomics and safety are stressed. The goal at the end of the school year is to achieve 35 mph with the same power plant. Next year's Phase III will be to study and fabricate a lightweight composite shell and to hybrid the fuel cell with cutting edge batteries.

The educational officer is preparing a new PowerPoint® presentation for some conferences and board of education meetings where they plan a presentation. She, along with the class bursar and field trip planner, are preparing for a presentation in Shanghi this summer where they will display and describe their project at a science and technology expo.

All students enrolled in these Systems of Technology classes are respected and trusted by their peers and the educational community and have a sense of pride in their accomplishments.

Key Contact Person:

Leon Strecker
Darien High Fuel Cell Project
80 High School Lane
Darien, CT 06820
Telephone: 203.655.3981
Email: LStrecker@darien.k12.ct.us
School Website: http://www.darien.k12.ct.us/dhs/index.html
Website: http://dhsfuelcell.com/

Best Practice: *Structuring Activities for Intrinsic Motivation*

Best Practice Nominator: Steve Shumway

Description of Best Practice: A review of research on motivation theory indicates that if teachers create opportunities for their students to perceive that they are competent or perceive that they have autonomy, then their students will likely have increased intrinsic motivation toward the subject. Unfortunately, many of my practices as a new high school teacher did not reinforce these principles. For example, as a high school teacher, when I would write a laboratory activity for my students I followed the example of my university professors. I provided the students with detailed step-by-step instructions that told them what to do, exactly how to do it, and for how long. This method worked with highly motivated college students but didn't work as well with my high school students.

I was disappointed that the high school students didn't seem to be as excited about doing the laboratory activities as I was in creating them. It took me a while to realize that I was doing the interesting work (designing and creating) and they were performing laboratory activities that gave them little opportunity to think, design, create, troubleshoot, or perform other autonomous activities. No wonder they were not intrinsically motivated to perform the activities.

This principle was reinforced when I visited student teachers who were placed in modular labs where the students were required to sit at a station and read through a detailed set of instructions that walked them through a learning activity. It was amazing to watch students complete an entire module and correctly answer each of the questions, but be unable to tell you what they learned from the activity.

I came to the realization that I needed to formally add opportunities for autonomy into each laboratory activity that I had the students perform. I came up with what I call, "Shum Challenges." (I later called them "Engineering Challenges.") These were challenges that I would place throughout the laboratory that consisted of troubleshooting opportunities where I would place "bugs" into the activity that students needed to solve or problem solving opportunities that required the students to design a solution. Rewriting these activities took much creativity and effort on my part but the results were fantastic. Soon I had high school students designing and building robots, vending machines, sumo-bots, and automated work cells from scratch materials rather than putting together kits. The students' excitement and motivation for the class increased and my enrollments increased significantly.

Perceived autonomy; however, can be a two-edged sword. Too much autonomy, especially without perceived competence, can lead to student frustration and failure while as previously stated, too little autonomy stifles excitement and motivation. Teachers need opportunities to meet with their colleagues and evaluate their own curriculum materials to see if appropriate amounts of perceived autonomy are provided for the students.

Key Contact Person:

Steve Shumway
Technology Teacher Education
Brigham Young University
Provo, UT 84602
Telephone: 801.422.6496
Email: Steve_shumway@byu.edu

Best Practice: *Middle School Curriculum*

Best Practice Nominator: David Greer

Description of Best Practice: The instructor in this program brings a unique perspective to the classroom as she comes to the program from an engineering background. Using this background, she has integrated two distinctively different instructional programs (Synergistic and Project Lead The Way) to provide an innovative pre-engineering program at the middle school level. The program offers the Gateway to Technology (middle school pre-engineering program) and is a pilot for the new Aero Space unit. The teacher is also Project Lead The Way Master Teacher. The program is for the students, but the ultimate success of the program is directly related to the teacher.

Key Contact Person:

Barbara Kubinski
Nichols Junior High
2201 Ascension Blvd
Arlington, TX 76006-6246
Telephone: 817.801.2626
Email: bkubinsk@AISD.net

Best Practice: *May Fair*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: What happens when high school students mix with senior citizens? It's May Fair! May Fair is the name given to a special May event that is planned and organized by technology education students enrolled in a manufacturing class at North Penn High School. The technology education students often work in cooperation with other students enrolled in programs such as art and family and consumer science to help organize the event. On several occasions, this event has been held at a local senior citizens center, but it has also been done with preschoolers and could be organized around other groups.

Students choose a theme and create a series of activities pertaining to that theme that would be of interest to their clientele. They spend about 9 weeks preparing for this event by making the necessary items and organizing the activities. On the scheduled day, they travel by school bus to their clients' location and put on May Fair for a few hours. During one May Fair event, for example, students chose a train theme for the senior citizens. They built a putting green with a locomotive theme and gave out train gumball machines as awards. They snapped and printed digital pictures of the seniors donning conductor caps and gave out shaped magnets that were screen printed by graphics students. They even collected train artifacts and displayed them for the seniors to enjoy.

Each time May Fair is scheduled, a new theme is chosen and students get the opportunity to apply their creative talents to planning another great day. As another example, senior citizens once enjoyed "A Day at the Beach" at May Fair, complete with a lighthouse and snapshots as "muscle men" and "bikini babes." May Fair has also included some electronic games designed by students in another technology education class. The opportunities are endless, especially when you get others involved.

This interdisciplinary technology education activity benefits students and community members. When students work with senior citizens on a fun project such as May Fair, they begin to see these elderly folks in a new light – as active, productive citizens. Likewise, senior citizens have the opportunity to see high school students as creative, enthusiastic, and caring individuals. The May Fair activity challenges students to design solutions with "real" clients in mind, making the design/build experience much more meaningful. In addition, they learn a lot about teamwork when they work together for a good common cause. The sense of pride that students feel when they see their clients' excitement is a great reward for all their hard work and effort.

Key Contact Person:

William Michael
North Penn High School
Technology Education Department
1340 Valley Forge Road
Lansdale, PA 19446
Telephone: 215.368.9800 ext 460
Email: michaewm@npenn.org

Best Practice: *Student Assessment*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: Several practices are used in Chip Miller's technology education classrooms at Summit High School that are consistent with the research recommendations on knowing what students know. Chip uses portfolios to collect student evidence of learning. Mastery learning is woven throughout the curriculum. Students complete assigned work and projects to high standards prior to continuing onto other assignments. A Palm (PDA) based system of portable grade collection is employed for on the spot feedback to students.

Student progress should be assessed using a variety of tools and measures. Assessment should be non-linear. Opportunities for student achievement and success must match the diverse nature of our students. A broad array of measures, combined with one-on-one teacher feedback, provides opportunities for every student to be their very best.

Key Contact Person:

Lemuel "Chip" Miller, DTE
Technology Education
Summit High School
Bend – La Pine School District
2304 Clearwater Drive
Bend, OR 97701
Telephone: 541.322.3204
Email: lemiller@bend.k12.or.us

Best Practice: *Identifying Exemplary Technology Teachers*

Best Practice Nominator: Philip A. Reed

Description of Best Practice: There are several significant studies that highlight what an effective teacher does in the classroom. For example, Flanders' interaction analysis categories (1970, *Analyzing Teaching Behavior*) show how effective teachers interact with students. More recently, five key behaviors and five helping behaviors explain what teachers can do to have a significant impact on student learning (see Borich, 1999, *Effective Teaching Methods*). In the technology education classroom, however, the learning environment is complex and exemplary activities extend outside the school. There are 'great' technology teachers but what makes them great? Obviously, some of the characteristics would include participation in local, state, and national/provincial associations, active involvement in student associations (e.g. Technology Student Association), curriculum development, and presenting at professional functions. A model for technology education teachers would be helpful for teacher education programs and for providing strategies to in-service teachers. The first step is to identify teachers that are recognized for being exemplary. Many such teachers are identified in this book. The second step would be to ask them how they do it and to get them to put their ideas into a form that could be shared (i.e. video, publication, and workshop). One teacher who frequently shares her successes through presentations and state association involvement is Andrea Adams.

Key Contact Person:

Andrea H. Adams
1226 South Crescent Road
Harrisonburg, VA 22801
Telephone: 540.568.6568
Email: adamsah@jmu.edu

Best Practice: *Technology Days*

Best Practice Nominator: Bill Paige

Description of Best Practice: Technology Days is an activity that is designed to help the people who live in a community become more technologically literate, better understand what technology education is and is not, and encourage students to consider teaching technology education as a career path. Students teach technology education lessons covering topics in communications, transportation, and manufacturing. Participants are solicited by an advertisement in the local newspaper. Technology Days allows classroom teachers to showcase their technology education program and it is a wonderful public relations tool. It also provides students an opportunity to "show their stuff" to adults in the community.

Key Contact Person:

Karen Sue Harris
Department of Industrial Technology
Purdue University
Rm 377-D Knoy Hall of Technology
401 N. Grant St.
West Lafayette, IN 47907
Telephone: 765.496.2383
Email: ksharris@purdue.edu

Best Practice: *Team 384*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: Since 1989, school teams from around the United States and the world have competed in FIRST (For Inspiration and Recognition of Science and Technology) Robotics tournaments. These events "team professionals and young people to solve an engineering design problem in an intense and competitive way. The program is a life-changing, career-molding experience" (FIRST, 2005, http://www.usfirst.org/robotics/). Team 384, creators of Sparky 6.0 (the robot), would assuredly agree with this statement. Students (about 40 of them) at John Randolph Tucker

High School are currently working with approximately 20 mentors and volunteers (coaches and advisors from school and industry) to solve the 2005 challenge titled "Triple Play." Students design and build a robot using engineering design and technical skills primarily developed through technology education classes. Using their communication technology skills, they also document the process with a robust website, photographs, digital video, and a vast array of promotional materials including mouse pads, mugs, shirts, and a teddy bear.

This is not a simple competition. It's an intensive experience that requires a lot of human resources and a major commitment from students, faculty, and other volunteers. This year Team 384 also worked hard to garner more than $40,000 from numerous sources to support their project, thanks to help from their advisors, mentors, and a booster club that wrote grants. According to Marshall Turner, FIRST is the "only program that brings together the community and sponsorships" like this.

Team 384 regularly works during classes, after school, and on weekends. They formed four sub-teams to get the job done (business, manufacturing, media, and strategy). Together, they work to solve the problem (in just 6 weeks) and document the process (before, during, and after tournaments), often relying upon the expert advice of their mentors. They also work throughout the year to develop preliminary designs and build/test prototypes – all to improve their chances of building the best robot. Moreover, they even take timeout to do volunteer work such as conducting workshops in middle schools to build enthusiasm for robot design and visiting local hospitals to engage sick children and teens in the exciting world of robotics.

There is nothing like a little competition. It motivates students to work harder. It challenges them to think deeper. And, it rewards them by building their confidence and enthusiasm for learning. It definitely has a positive impact on enrollment in technology education classes and it may influence their career decisions. FIRST Robotics is just one example of how technological competition can spur a variety of innovative design experiences in technology education classes. Through these experiences, students strengthen their technical skills in many areas and build interdisciplinary skills in technology, science, and mathematics. They experience the value of collaboration and they feel the pride and enthusiasm that comes with team efforts. The benefits of this kind of experience are immeasurable and the memories are sure to last a lifetime.

Key Contact Persons:

Marshall Turner, Julie Norris, & Terry Daniels (Technology Teachers)
plus Bob Benway (Physics teacher) and many other mentors
John Randolph Tucker High School
2910 Parham Rd.
Richmond, VA 23294
Telephone: 804.527.4600 (ext 7091 – Turner) or (ext 7095 – Norris)

Email: msturner@henrico.k12.va.us and jdellis@henrico.k12.va.us
School Website: http://www.henrico.k12.va.us/HS/Tucker/#
School's Robotics FIRST Website: http://www.sparky384.com/

Best Practice: *Battling Robots*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: Pamela Wilkins teaches a course in Engineering Technology at Littleton High School. She challenges her students to design and innovate through the use of a design challenge for battling robots. This problem solving approach is one that has many possibilities for creative teaching. The approach being used in the battling robots design challenge can clearly be used in many circumstances and is probably one of the most exciting teaching techniques that can be used in technology education.

Problem solving activities have become very popular in educational and industrial settings in recent years. One of the key skills that employers want their employees to possess is the ability to critically analyze situations and solve problems. The difficulty is that the term "problem solving" (and the behavior and thinking associated with it) is complex and refers to different things in various contexts; therefore, in technology education and indeed in this example of a best practice, the technological problems associated with this robotic artificial intelligence challenge is distinct from other types of problems.

Pamela teaches a unit on designing and building a battling robot. Students learn to integrate, manipulate, and solve the design challenge through the application of their knowledge of pneumatics, electronics, mechanical advantages, CADD, and manufacturing. Pamela states the following: "My students were so fired up and excited about learning. They worked in teams to raise money to fund their projects. Students often build the battle robot on top of a Radio Controlled car chassis."

Key Contact Person:

Pamela Wilkins
Littleton High School
199 E. Littleton Blvd.
Littleton, CO 80121
Telephone: 303.347.7739
Email: pwilkins@lps.k12.co.us

Best Practice: *Teaching Academic Content in Technology Education*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Technology Education has long been thought of as a perfect vehicle for academic integration. However, when pushed to have teachers document the integration, little substance is attainable. Through an innovative program with Volusia County Schools and the International Center for Leadership in Education, teachers have been developing high quality materials using a matrix which is correlating the projects found in technology education into the academic state standards and national standards, plus the correlated essential work skills. This is the first time in history that teachers now understand and can teach true integration and show how it is accomplished. Perkins' funds are used to finically support this project with the deliverables available to others at no cost.

Key Contact Person:

Dannel Cox
Technology Education Supervisor
Volusia County Schools
729 Loomis Ave.
Daytona Beach, FL 32114
Telephone: 386.255.6475
Email: edcox@volusia.k12.fl.us

Best Practice: *Digital/Video Editing and Communication*

Best Practice Nominator: Michael A. De Miranda

Best Practice Description: An important technique emphasized in Pamela Wilkins' Engineering Technology course at Littleton High School is one that is also used by videoographers when they plan their professional productions. This technique is called storyboarding. A storyboard is a series of sketches of the key visualization points of an event with accompanying audio information. A video should always tell some sort of story. A storyboard needs structure – a beginning, middle, and an ending point. Creating a storyboard supports recognized research recommendations for engaging students in reflection and critical thinking activities. Students enrolled in the technology education program at Littleton High School are required to assess their target audience and reflect on an effective approach in organizing and communicating their intended message. The metacognition component of this best practice requires students to reflect and develop answers to the following questions:

1. What are you trying to communicate?
2. Who is your audience?
3. What are your objectives for your video?

After selecting a video topic, this best practice exemplifies an exemplary approach to building and organizing a storyboard while constructing a concept map with concept mapping software. A concept mapping tool used in Pamela's class is Inspiration®. Inspiration helps students organize the content and illustrate the interrelationships of their video storyboard.

As a result of the student reflection and applying metacognition concept mapping contextualized as a video communication/production activity, students learn how to create their own movies, infomercials, etc. Through the use of video editing, digital audio, animation, and graphic design programs along with a green screen and studio lighting, Pamela's students create professional looking movies that are capable of being converted to DVDs.

Key Contact Person:

Pamela Wilkins
Littleton High School
199 E. Littleton Blvd.
Littleton, CO 80121
Telephone: 303.347.7739
Email: pwilkins@lps.k12.co.us

Best Practice: *Motion-Time Study*

Best Practice Nominator: Bill Paige

Description of Best Practice: This is an interdisciplinary learning activity in which multiple manufacturing/assembly activities apply math and communication skills, along with principles of science and social studies in learning that connects students to the real world beyond the classroom. After the initial individual assembly familiarizes students with a LEGO or similar kit, other assembly methods are explored. Teacher-guided discussion after each activity helps students to discover what they learned. After completing three assembly activities, students take a video field trip by viewing *How a Car Is Made*, a tour of the Ford Mustang production facility. The unit is concluded with a typewritten report in which students document their learning, including the use of collected data in graph and tables produced with MS Excel.

Key Contact Person:

W. L. "Pete" Brannan
Heritage High School
2400 Granade Rd.
Conyers, GA 30094
Telephone: 770.483.5428 ext 191
Email: pbrannan@rockdale.k12.ga.us

Best Practice: *Using the Design Process*

Best Practice Nominator: Marie Hoepfl

Description of Best Practice: Although the processes of "engineering design" are featured as a major component of the *Standards for Technological Literacy*, many technology teachers are not very familiar with how this approach can be used as a way of structuring study and practice in the technology education classroom. Trey Moore is a middle school technology teacher in Wilmington, North Carolina who has used his background as an industrial designer in effective ways in the technology classroom.

At the middle grades level, Trey recognizes that in many cases he is introducing his students to the tools and processes of design, in addition to the study of technology. He focuses attention on the use of sketching, drawing, and modeling as ways of exploring new ideas in technology. At the same time, the design process is used as a way of helping students view technologies through a systems approach, in the sense that students begin to learn that decisions about how a technology looks and works can have much larger implications. Recently, he has begun to make use of the "Stuff that Works" materials developed by Gary Benenson and colleagues at the City University of New York and published by Heinemann. These materials introduce students in grades K-6 to the engineering design process in a variety of common areas including packaging, use of symbols, and more.

Key Contact Person:

Glenn (Trey) Moore, III
M C S Noble Middle School
6520 Market Street
Wilmington, NC 28405
Telephone: 910.350.2112
Email: gmoore@nhcs.k12.nc.us

Best Practice: *Integrated/Multidisciplinary Projects and Assignments*

Best Practice Nominator: Michael A. De Miranda

Best Practice Description: At Boltz Junior High School in Fort Collins, Colorado, most of the projects and lessons taught in Tom Smith's Applications in Technology course are based on the *Standards for Technological Literacy* document (a publication of the International Technology Education Association). The projects and lessons contain integrated/multidisciplinary components directly related to other educational disciplines. Specifically, any given component might be related to various aspects of mathematics, science, reading, art, and language.

Tom's academic argument is that in the real world almost everything we do as adults is multidisciplinary. For example, when one thinks of Leonardo da Vinci, one thinks of his true multidisciplinary approach? His many and varied scopes of interests and projects, from paintings to imagined flying machines, were all multidisciplinary. It is for this reason that Tom firmly believes that technology education teachers should try and relate the relevancy of multiple disciplines in the technology education classroom. An example of this approach might include students calculating the force, gear ratios, and the energy efficiency required to construct a small student-built hybrid car that is capable of traveling several hundred feet. With this assignment, the students must address physics and mathematics and the language component of this assignment might be writing a technical analysis or reflection on how a hybrid vehicle impacts the environment. As a student commented, "We learn stuff we can use in real life."

Key Contact Person:

Thomas H. Smith
Christa McAuliffe Teacher Award Fellow
Boltz Junior High School
720 Boltz Drive
Fort Collins, CO 80525
Telephone: 970.472.3783
Email: thsmith@ psdschools.org

Best Practice: *A Technology Education Online Interactive Curriculum Tool*

Best Practice Nominator: Doug Wagner

Description of Best Practice: Technology education teacher Rob Schwartz has created a learning environment (http://www.brainbuffet.com) that takes advantage of today's Internet accessibility. All lessons are posted on the program's website and students use computers to access the material. The beauty of his effort is that when students are absent from class, they can access the website from home, complete the assignments, and then show up at school "all caught up." While using the Internet is nothing new, Rob has a full eight year track record of performance and student success based on this model.

Key Contact Person:

Rob Schwartz
Technology Education Teacher
Palm Beach County School District
Seminole Ridge Community High School
4601 Seminole Prtt Whitney Road
Loxahatchee, FL 33470
Telephone: 561.422.2600

Email: Rob@brainbuffet.com
Website: http://www.brainbuffet.com

Best Practice: *D.I.R.T. in a Democratic Classroom*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: The physical aspects of the Boltz Junior High School technology education laboratory make the overseeing of student management a logistical nightmare. Three separate rooms are connected by short passageways. It is common to find multiple assignments and activities going on simultaneously in all three laboratories, which makes managing the facility an interesting prospect at best. In order to cope with the issues presented by the physical layout of the laboratory and Tom Smith's obsession with having up to 9 different projects and assignments progressing at the same time, Tom developed a fairly unique management style.

During the first day of class, Tom explains the situation to the students. His lecture to the students goes something like this: "There are lots of things to learn and lots of things to do in this facility. A lot of what you do will be fun and I believe the planned activities will include a very unique learning experience. But, for liability reasons and my sanity, everyday that you walk into this facility you have to bring something special with you."

He affectionately calls it D.I.R.T. – Dignity, Integrity, Respect and Trust. Tom explains to his students that in order to work constructively in the technology education facility, they must treat everyone with Dignity; and since he can't be in all three rooms at one time, they must operate with Integrity, as if he were there with them. They must respect their fellow students and the laboratory. He also has to be able to trust them to "do the right thing." Tom explains that this is the only way he and the students can have the freedom to experience and operate in (since they choose what they want to work on at any particular time) a democratic classroom.

When asked, Tom repeated, "Why is this a Best Practice? In the 18^+ years I've been doing this, in 98 percent of the time, 98 percent of the students' behavior has been AWESOME!" Check out what the students say: "Freedom and freedom with limits, he (Mr. Smith) trusts us to be responsible. We have a say in what we want to do which is active personal freedom."

Key Contact Person:

Thomas H. Smith
Christa McAuliffe Teacher Award Fellow
Boltz Junior High School
720 Boltz Drive
Fort Collins, CO 80525

Telephone: 970.472.3783
Email: thsmith@psdschools.org

Best Practice: *A Spiral Curriculum Design*

Best Practice Nominator: Vincent Childress

Description of Best Practice: Many people in the profession believe that a curriculum should have both breadth and depth. They promote the learning of a concept in a variety of contexts and in a succession of activities. This principle of curriculum structuring is also supported by the explanation of vertical integration of curricula. Unfortunately, many technology education curriculums do not offer a scope and sequence that appropriately spirals conceptually. For example, in some states, provinces, and countries, the responsibility for curriculum development is jealously guarded by central powers that often result in the denial of responsibility to key stakeholders (e.g., classroom teachers). In other school structures, curriculum development may be totally ignored. Therefore, a program's breadth to depth, a spiral curriculum design, should begin with the *Standards for Technological Literacy* (STL) and then build upon the standards.

The curriculum at Middle Creek High School in Apex, North Carolina begins with Fundamentals of Technology (based on the STL), a very general technology course. It is then followed by Communication Systems (based on the STLs). Communication Systems is more specific than Fundamentals of Technology but is general in nature relative to the rest of the program's communication technology sequence. Other courses in sequence after these two foundation courses include Digital Media, Graphic Arts, Computer Engineering I and II, Network Engineering I and II, Principles of Technology I, and Principles of Technology II.

The following link is to the faculty contact page at Westbrook's website:
http://middlecreekhs.wcpss.net/career&technical.html

The following link is to Westbrook's technology education website:
http://middlecreekhs.wcpss.net/Tech%20Webpage/mchs.html

Key Contact Person:

Terry Westbrook
Middle Creek High School
123 Middle Creek Park Avenue
Apex, NC 27539
Telephone: 919.773.3838
Email: twestbrook@wcpss.net

Best Practice: *Now Entering the TechZone: Dispositions for Learning*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: At Boltz Junior High School, Tom Smith expresses his philosophy in the following way: "I want kids to open up an imaginary box of knowledge about the real world of technology and go WOW! I want them to leave my class everyday and go 'WOW, that was cool'."

Tom Smith believes that teachers should challenge students to seek varied solutions to the problems they experience in each academic discipline, in their own lives, and in our technological world. A technology education classroom should be an interesting, challenging, and exciting learning environment, filled with excitement, enthusiasm, intriguing machines, high-tech equipment, and visual experiences. Tom wants his students to understand the process of learning and to receive a proactive education. He also wants his students to enjoy learning each day and to enjoy learning for its own sake. In teaching technology education, Tom desires for young and old alike to know the implications of technology while understanding and appreciating both good and bad of technology. He believes students should envision possible futures. Much of what Tom teaches is concerned with our tomorrows, how we might live, what we might expect, and how we can plan for and cope with change. Tom tries to give students basic skills for life, conveying the past, present, and the future.

Tom Smith appreciates each student as an individual. All of us have specific wants and needs and Tom firmly believes he must be attuned to them. Tom makes it a point to acknowledge significant events in his students' personal lives, whether it is membership in the National Honor Society, an athletic triumph, participation in community service, or simply asking a good question in class.

Tom Smith shares a deep commitment for students to understand our technological world. He always shares with his students his strong interest in new technologies and inventions. He reviews current discoveries in each class while relating the impacts and implications concerning both the sublime and controversial technological issues. As the occasion presents itself, he assumes the role of "devil's advocate," while taking a stand that is outlandish or counter to prevailing opinion. He engages his students in classroom discourse to argue their case, to explore and weigh his argument on the topic and that of others, and to disagree intellectually. Ultimately, he works to improve the critical communication skills of all his students.

One strategy Tom Smith employs each year is to significantly change his course materials to match the individual needs of his students. Obviously, this helps him to nurture his own personal growth. Challenge and change are important topics he teaches his students. Tom believes that if he is excited about new materials and contemporary activities, his students will be just excited also.

Tom Smith uses a self-grading system to grade himself at the end of each class, and he grades himself hard. Tom constantly seeks to improve his course content, teaching methods, and his interaction with students. He promotes teaching as a cooperative venture with students as well as teachers sharing and evaluating teaching techniques.

In summary, Tom Smith believes technology education is essential for all students. He also believes that a teacher should love kids and derive genuine pleasure from watching them grow and mature while helping them along. So, as one of Tom's students stated, "nothing is ever boring."

Key Contact Person:

Thomas H. Smith
Christa McAuliffe Teacher Award Fellow
Boltz Junior High School
720 Boltz Drive
Fort Collins, CO 80525
Telephone: 970.472.3783
Email: thsmith@psdschools.org

Best Practice: *Performance Assessment and Alternative Assessment*

Best Practice Nominator: Vincent Childress

Description of Best Practice: In an effort to measure and document student achievement in technology education, it is important to describe performance through a variety of means. The use of rubrics and checklists is a programmatic way to tie objectives related to the "doing" of technology to achievement in the subject area. Insofar as it is agreed that problem solving and other activities related to the objectives of technology education are activity-based performance requirements of students, the development and use of performance rubrics are fundamental best practices. Sherry Wallace has been a leader in the development and use of these assessment techniques.

The following is a link to Wallace's technology education program:
http://schools.guilford.k12.nc.us/spages/NW/nwhs_index.html

Key Contact Person:

Sherri Wallace
5240 Northwest School Road
Greensboro, NC 27409
Telephone: 336.605.3300
Email: hsteteach@hotmail.com.

Best Practice: *Plate Display Package*

Best Practice Nominator: Bill Paige

Description of Best Practice: The Plate Display Package activity reinforces measurement and pattern making/transfer while teaching about package design and development and product marketing. In the activity, students are provided limited amounts of materials consisting of poster board, transparency film, paper, glue, and tape. They must then design and construct a package that will display and protect a glass plate. Once the students' packages are completed, they conduct a drop test of each package from a distance of five feet (to simulate the package falling off of the shelf on which it is displayed). The packages that survive the drop test are then wrapped in brown paper and shipped through the US mail to another school, usually a school either in California or New York. (This step is designed to simulate shipping of products from the factory to the retailer.) The teachers at the receiving schools then examine the packages to ensure that the products are in tact. Sometimes the teachers will complete a second drop test, just to test the rigors of shipping.

Key Contact Person:

Pamela J. Brown
Smokey Road Middle School
965 Smokey Road
Newnan, GA 3026
Telephone: 770.254.2840 ext 222
Email: pamela.brown@cowetaschools.net

Best Practice: *Electronic Portfolios*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: An electronic portfolio is a digital way of organizing a variety of information into an easily accessible and transportable medium. As Teri Tsosie continues to develop and manage her Hermosa Valley School's Exploring Technology Laboratory, she has found that a paperless laboratory is on the cutting edge of communications technology. So, why not have a paperless assessment? As a result of this best practice, certain advantages have become evident using Electronic Portfolios.

Electronic Portfolios afford teachers the ability to record and assemble a variety of performance-based outcomes. Any performance can be recorded, even when there is no paper product to show for a student's achievement. For example, when students in Teri's class wanted to show how their machine worked, they recorded it on live video. Hyper Studio/Web Page is the easiest way to accomplish this task. When a student wanted to show how great his dragster looked, the Electronic Portfolio allowed him to capture a permanent, colorful image of his work. If technology is used to produce work, then using technology in the form of electronic portfolios allows for the best representation of that work.

The three dimensional qualities of a multimedia presentation can best be shown in an Electronic Portfolio format. The Electronic Portfolio captures the sounds of many performances that include the voices of those students involved, bringing this form of assessment alive in a way we might never have experienced in a traditional technology education program. By taking advantage of integrated technologies, this type of portfolio has become much more representative of performance-based work with addition of sound, video, graphics, and photographs. Instead of the flat character of paper portfolios, electronic portfolios capture and preserve important features of students' original performances.

What is the difference between a webpage and an electronic portfolio? Since both can be web-based, the main difference is the storage medium. A web page is accessed through the Internet and it is generally stored on a remote server. Electronic portfolios are locally stored on a number of possible portable storage devices like floppy disks, local servers, CDs, or Zip disks. This type of portfolio has the distinct advantage of maintaining student privacy of personal information yet allowing them to learn how to design and build web pages. When used as a portfolio, the digital medium also allows for inexpensive reproduction and it is easily updated. It is one of the only vehicles that can incorporate rich media content such as video, digital images, animation, sound, and interactive text.

The Electronic Portfolio is a best practice on the cutting edge of communication technology. It is one of the best communication projects that can be used in our technology education classrooms. It not only incorporates the design process but also helps us position ourselves as relevant and up-to-date in the highly competitive education arena where assessment and use of information technology are current topics of high priority.

Student learning and the emphasis on relevancy and authentic applications have created a growing demand for dynamic assessment strategies and instruments that measure multiple dimensions of a student's academic process. Is there a better best practice to show the "real thing" than a multimedia Electronic Portfolio?

Electronic portfolios in technology education (a) allow for computer skills to be taught, (b) allow for easier storage/access, (c) allow for great creativity and personalization, (d) facilitate the use of multimedia format which is intriguing to many and easy to share, (e) encourage self-reflection, a primary purpose of portfolio assessment, and (f) can be tailored to many different learning environments and user personality emphasizing various goals, outcomes, and priorities.

Key Contact Person:

Teri Tsosie
Hermosa Valley School
1645 Valley Drive
Hermosa Beach, CA 90254
Telephone: 310.937.5888 ext 223
Email: ttsosie@bnet.org

Best Practice: *Integrating other Core Subject Concepts and Competencies with Technology Education*

Best Practice Nominator: Vincent Childress

Description of Best Practice: Curriculum integration is a major means for creating relevancy in the curriculum. When technology education is integrated with other subjects such as mathematics and science, then students begin to understand *why* they need to learn. It is unusual to find teachers correlating curricula on an ongoing basis. Randy Overcash has been highly successful at integrating academic skills and concepts into his technology education instructional program. He has worked closely with his principal and academic coordinators at his school in order to integrate key concepts into the curriculum. Most of these concepts have helped his students become better problem solvers. Overcash's approach to curriculum integration has been an attempt to improve student performance on standardized testing in the academic core subjects.

Key Contact Person:

Randy Overcash
Concord Middle School
1500 Gold Rush Drive
Concord, NC 28025
Telephone: 704.786.4121
Email: rovercas@cabarrus.k12.nc.us

Best Practice: *Problem of the Week*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: In Teri Tsosie's Exploring Technology course, students learn about the design process and how it is used in industry. Each week students have the opportunity to put this design process into practice. Each grade level is given a "Problem of the Week" to solve. All problems are posted on the web for students to view, just in case they lose their packets or forget their homework at school.

The unique component of these problem-solving activities is the assessment. Students receive an A, B, or F each week for a grade. Students receive an A grade if they solve the problem, it functions properly, and if it fits all criteria. Students receive a B grade if it doesn't fit the criteria, or if it doesn't function properly. An F grade is awarded for no participation. Applying this grading system to the "Problem of the Week" lowers the students' affective filter and Teri reports that 99% of her students participate weekly in the "Problem of the Week" exercise. They look forward to this homework and often get quite competitive with their classmates.

Students are also provided the option of going back home and improving their design to raise their grade to an A. Each week students are rewarded on their designs in a number of ways including best design, most humorous design, best functioning design, etc. Students receive their picture on the "Wall of Fame", which is located in the classroom and also on the "Web Page of Fame", which is located on the technology laboratory website. Students are awarded a certificate to take home to share with their family that directs them to the website. This allows for parental involvement and also guides parents to the technology laboratory webpage where they can find other useful information about the technology education program at Hermosa Valley School.

There is also a rule that parents may not help their son/daughter solve the problem. Teri indicated that when she started this activity, she had a number of parents that wanted to solve the "Problem of the Week" for their child. Due to the popularity of this learning activity among parents, students now have the option of giving the problem to their parents and bringing their parents' solution to class as well as their own. Teri noted that she has had many parents send in projects and then show up on testing day with their own design. Now Teri has a local company representative who discusses with the students via email possible solutions to the problem.

The "Problem of the Week" activity has allowed Teri's students to learn how to use design process techniques to solve technology problems. Her program has carried over into the whole school. Teachers and staff have integrated this best practice approach into *needs* and *wants* within Hermosa's school setting. Students are provided with real problems within the school to come up with solutions with the result being that many students have successfully solved difficult challenges for teachers.

These "Problems of the Week" can been viewed online at http://hbcsd.org/techno.htm. You must look under the homework tab then navigate to the grade level of your choice.

Key Contact Person:

Teri Tsosie
Hermosa Valley School
1645 Valley Drive
Hermosa Beach, CA 90254
Telephone: 310.937.5888 ext 223
Email: ttsosie@bnet.org

Best Practice: *A Model Elementary/Middle School Technology Education Program*

Best Practice Nominator: Chris Merrill

Description of Best Practice: If we want our society to be more technologically literate, we need to start educating our students to be technologically literate at an early age. Typically, a technology education or a technological literacy approach starts at the upper middle school and continues through the high school level.

At the heart of any successful technology education program are instructors who craft their teachings around the interests of students, community, and self. The uniqueness of technology education is that the problem solving and design aspect can be centered upon a theme unique to a regional area while capitalizing upon the composition of the labor force and/or regional interests. Incorporating a curriculum based upon activities with real world relevance stimulates student interest, while at the same time encouraging community support with parental and business populations.

Within the Blaine County School District in Hailey and Ketchum, Idaho lie two schools with a teaching emphasis centered on an aerospace technologies theme unique to the National Aeronautics and Space Administration (NASA). K-5 students at Hemingway Elementary School and 6-8 students at the Wood River Middle School explore and learn about technology in an environment where local engineers and architects are often called upon to share their expertise with students. Dozens of community volunteers have worked with the students and teachers to help design, build, and test projects including microgravity drop towers, futuristic Martian colonies, space station simulators, Mar's rovers, wind tunnels, and flight simulators.

Students in these schools investigate these real world technologies in a non-linear environment in which student interest and questioning can often dictate the direction of the curriculum. For example, a question based upon an observation on the evening news on the latest NASA mission oftentimes leads the daily activity in an unplanned direction. While going against the trend of developing a rigid lesson plan followed to the finest detail, this type of teaching encourages student participation and builds a program with student ownership. Empowering the students to become active members of their learning, while exposing them to many career fields, creates a dynamic learning environment where recruitment of students is not an issue. The majority of students eagerly anticipate the next trimester or year's advanced technology offerings.

Key Contact Person:

Doug Walrath
444 E 100 So
Logan, UT 84321
Telephone: 208.720.9937
Email: walrathd@comcast.net

Best Practice: *Showing Students that You Care*

Best Practice Nominator: Marie Hoepfl

Description of Best Practice: Sometimes the most important teaching practices are those that are not specific to teaching technology education. One of the few things that I personally remember from my long-ago methods class as an undergraduate student was an anecdote that my professor told about a teacher who, when asked to identify her secret to many years of excellent teaching, said "I don't know, but I loved those children." It's a corny anecdote, but it sticks, while providing the message that teaching is more effective when the teacher cares about his or her students.

An exemplary teacher in North Carolina, Gary Atta, provides a one-day workshop for alternative-route licensure teachers as part of a workshop series these teachers are required to complete. Although Gary shares many good ideas with the teachers in these workshops, perhaps the most important handout he gives them is a list of encouraging statements he uses with his students. The statements serve as a reminder that in both word and action we must treat students with respect and show them we care. His list contains approximately 100 encouraging phrases: "Now you have the hang of it;" "I knew you could do it;" "Tremendous!" "You're really working hard today;" and so on. While it may not be a script that every teacher should memorize, it's a useful reminder to hang on one's office wall. Enthusiasm and caring go a long way.

Key Contact Person:

Gary Atta
Providence High School
1800 Pineville-Matthews Road
Charlotte, NC 28270
Telephone: 980.343.5390
Email: Gary.atta@cms.k12.nc.us

Best Practice: *Modular Classrooms and Student Rotation through the Units*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: Engineering the classroom learning environment for optimal instruction by manipulating variables for school learning is a best practice informed by research on teaching and learning. (Engaged time, time on task, opportunity to learn, ability to understand instruction, instructional time)

Most of the technology laboratories in California have a set number of modules that students rotate through while taking an average of 5 to 10 days to complete their learning tasks (programmed learning). Teri Tsosie at Hermosa Valley School reported that this did not work well with her students. Student performance was low as well as the quality of their output. Teri has reconfigured her program so students work at their own pace (opportunity to learn) and with the goal of producing quality work that they value. Students work with partners, however, they work within a team at the same time while completing the same task. Within each team students do work at their own pace and move on to the next unit when they are ready and have completed a quality job (mastery learning). The teams continuously change as new students join teams and others leave to move to their next unit. This dynamic team sharing approach and students working at their own pace have truly provided Teri's students the opportunity to produce quality work which they value and understand.

Key Contact Person:

Teri Tsosie
Hermosa Valley School
1645 Valley Drive
Hermosa Beach, CA 90254
Telephone: 310.937.5888 ext 223
Email: ttsosie@bnet.org

Best Practice: *Technology Education for All Children (K-4)*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: While just a few elementary technology education programs exist in the United States, one program clearly stands out amongst them. This program serves all children in grades K-4 through a dedicated elementary technology teacher and classroom/laboratory known as the "TECH room." The TECH room is the result of the efforts of committed parents, business persons, and educators who envisioned the need to provide all children with more opportunities for hands-on math and science – which is one meaningful way that technology is approached in elementary schools. All K-4 students have time scheduled in the TECH room each week to explore a vast array of technologies while they apply technology, math, and science concepts/skills. The amazing thing is that most activities in the TECH room are nonlinear, meaning that a wide range of different things are occurring at any given time, thus enabling different students to explore many different topics concurrently. Students might explore alternative energy, biotechnology, robotics, engineering, construction, video production, aerospace, and more – all through project-based activities that are motivating and fun. The TECH room enables students to explore all areas of technology including the physical, biological/chemical, and informational systems. Students also begin to develop fundamental technological problem solving skills through an assessment approach that requires them to self-evaluate and reflect along the way.

In addition, elementary students also explore technology through amazing philanthropic activities that involve the entire school and encourage community involvement and awareness. For example, manufacturing came alive for these children when they mass produced "Techno-Treats" and sold them to raise money for the *Feed the Child* campaign. In a separate effort, students designed forms and vacuum-formed hearts that they sold to raise about $4500 for tsunami victims. The 3rd graders were in charge of all order data, order delivery, and accounting and learned the importance of math concepts, too. They came within $13.00 of the bank's figures and realized the importance of accuracy in the process. Through this activity, some students also conducted research and produced a video documentary about geophysical science to help educate others about these phenomena. Further, hurricane Katrina victims will also benefit from these youngsters' efforts. A recording was made of the children singing songs of peace and comfort and the students are setting up an assembly production line to package and sell the compact disks to raise much-needed funds to help people who suffered losses in this tragedy. Students were taught songs and recorded them in music class. The art teacher had students draw CD covers and then one was chosen for the cover and printed. Then the children in Technology set up production lines for the assembly of the cases, covers, CDs, quality control inspection seals, production, and order data. This Katrina effort represents collaboration between art, music, & technology, whereas all of the others were exclusively a school-wide tech project.

Elementary students seldom get the opportunity to study technology in any formal way through traditional schooling. But, when a school provides this opportunity for every student through every grade level, and commits the resources and space needed to do it, and then this is an amazing and noteworthy accomplishment. Through TECH experiences from grades K-4, more than 400 students from a diverse population (45% of the students for whom English is a second language) will experience the joy of designing, technological problem-solving, and engineering in ways that will likely leave a lasting impression. This flexible approach to technology education at the elementary level is a model and best practice that all schools should emulate.

Key Contact Person:

Krista Jones
Bellevue Elementary School
Bellevue, ID 83313
Email: kjones@blaineschools.org
TECH Room Website: http://www.bcsd.k12.id.us/bell/tech/bestech.html

Best Practice: *Community Involvement*

Best Practice Nominator: Vincent Childress

Description of Best Practice: Community involvement provides relevancy and legitimacy as inputs to the technology education program. Community members' excitement about the technology education program also makes the program important to school administrators. Personnel at Al Bishop's program regularly have various members of local businesses and industries team-teach in the technology education program. This practice, therefore, goes beyond inviting guest speakers and simply getting input from an advisory committee. The curriculum comes alive for both students and the community. As a result, students achieve at higher levels and the program gains widespread support. Originally, Al Bishop developed this relationship with the community while teaching at South Brunswick Middle School. Today, he is a technology facilitator for Brunswick County Schools.

Key Contact Person:

Al Bishop
Brunswick Learning Center
705 North Lord Street
Southport, NC, 28461
Telephone: 910.457.0777
Email: eabishop@oakisland.com

Best Practice: *Development and Implementation of a Creative, Standards-Based Curriculum*

Best Practice Nominator: Chris Merrill

Description of Best Practice: With the release of the *Standards for Technological Literacy* (STL) and the growing need to implement the STL in the classroom, the curriculum needs to be developed and implemented that is creative, pedagogically sound, and makes use of the backward design process, all of which should capture the essence of the STL.

Michael Geist is a high school teacher that designs experiences for his students that stimulate reactions to solving technical problems; they follow and resemble the engineering thought processes. Michael has found that student thinking and learning seems to most naturally occur during the trials and mishaps after poorly organized planning and preparation. At which point, failures and frustrations shut down the interest of the young mind leaving no time for true reflection. While looking at product design, Michael teaches his students to broaden the problem beyond the obvious functioning aspects, and to analyze problems related to marketing, shipping, safety, consumer handling, etc.

Michael believes that essential concepts must be enhanced through reading and writing as well as solving the problem. For instance, Michael makes use of design matrices for critical analysis, which may provide the student with potential solutions to problems that could trigger a "compare and contrast" type thought process. This matrix should include aspects of consequence, advantage/disadvantage, and include appropriate filters that can narrow design decisions and benefit the final products and outcomes. Thorough documentation and data usage is another factor that leads to a student who will benefit from this design process and utilize problem solving skills.

Michael believes to further enhance student in school, a focus must be placed on the instruction of design principles, not the design tools. Changing technology has predetermined the obsolescence of every software design package available or heard of today. Course objectives need to veer away from specialized computer software, and hone in on the principles that drive all of these digital packages. Teaching design can utilize a wide variety of these sorts of tools and yet take these applications even further by focusing on the elements that drive technological development.

Key Contact Person:

Michael Geist
Technology Education Teacher
Wheeling High School
900 S. Elmhurst Rd.
Wheeling, IL 60090
Email: Michael.Geist@dist214.org

Best Practice: *Tele-Virtual Manufacturing Technology*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: The objective behind this manufacturing unit is to introduce students to the world of manufacturing. Three schools are working collaboratively to produce a product and each student receives a finished product upon completion of the unit. Three different teachers in three different states brainstorm via email to design this unit of instruction. The amazing thing is the instructors have only met face to face for a few brief moments during an International Technology Education Association conference.

What is the manufacturing unit all about? One instructor teaches high school CAD in Nevada. Another high school instructor teaches graphics in New York. The third instructor teaches in a middle school technology education program in California. The objective behind this project is to have students in all three schools work collaboratively to produce a product and then package it.

The students in Nevada, for example, design the puzzle on a CAD program. Once they complete the drawings, they email them to California. The California students take the CAD drawings and manufacture the parts of the puzzle using a laser cutter. The students in California also write technical instructions on “how-to” build the puzzle. The instructions are packaged with the puzzle. Once the puzzle is manufactured, it is shipped to New York. The New York students design the package for the product. The New York students also design a logo and letterhead for the three-school company. When the first prototype is finalized, a cost analysis is conducted and then the tele-manufacturing and outsourcing schools start production.

As the product is being designed, students have the capability to talk with each other via a website that has been set up specifically for this activity. The website is student designed and maintained. The website has an area to post questions as well as a chat room for students participating in this best practice. The website was set up so all three schools' students have a virtual area to collaborate on the project; a "virtual collaboration" of sorts.

The culminating activity takes place when students from all three schools meet via video conferencing to have a face-to-face talk. This allows the students to meet their colleagues with whom they are in business.

The schools in this best practice are in the process of starting their second Virtual Manufacturing project to begin in the fall of 2004. You may view this project online at http://hbcsd.org/manufacturing/main.htm.

Key Contact Person:

Teri Tsosie
Hermosa Valley School
1645 Valley Drive
Hermosa Beach, CA 90254
Telephone: 310.937.5888 ext 223
Email: ttsosie@bnet.org

Best Practice: *3-D Imaging, 3-D Graphics, and Virtual Reality Systems*

Best Practice Nominator: Gregory Kane

Description of Best Practice: The objective behind these units is to demonstrate processes that for safety reasons cannot be demonstrated in a classroom laboratory or to demonstrate how the modern communications industry develops products to attract the attention of the consumer. The 3-D graphics and virtual reality units were designed to demonstrate the modern approach to design whereby a place or thing can be developed/visited in a virtual reality environment allowing designers to create in a low cost cyber environment before actual high cost physical construction takes place. This virtual reality approach also opens opportunities for experiences that otherwise not be available to students.

The unit in 3-D imaging was produced for the chemistry department at Greenwich High School. It demonstrates a process that cannot be physically observed within the laboratory because of high levels of ammonia and hydrochloric acid. The process for developing this presentation was complex but reflects the way the communications industry produces products. The students were required to storyboard the presentation, develop a videotape, and develop a 3-D graphics that would explain the process. The students were mentored by a chemistry teacher who now uses their presentation with other classes.

The unit in 3-D graphics and virtual reality was centered around a historical site close to Greenwich High School. The project is being worked on by 15 students. Together, the team is developing an educational game that will describe not only the structure of a historical building, but also its contents and significant facts that were discovered about the building. After completion of this virtual reality environment, the historical organization will use it with groups to introduce them to the facility. The game is also designed to be used by elementary and middle school students prior to visiting the site. There are also plans to share it with homebound citizens so they too can visit through a virtually trip what the historic site has to offer.

Key Contact Person:

Phil Nobile
Greenwich High School
10 Hillside Road
Greenwich, CT 06830
Telephone: 203.625.8000
Email: philnobile@hotmail.com
School Website: http://home.greenwich.k12.ct.us/ghs/

Best Practice: *Non-Linear Approach to Teaching*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: This unique approach to teaching capitalizes upon student interest and current events while teaching subject matter at a point in time which is relevant to student learning (teachable moments). Utilizing this approach, Doug Walrath at Wood River Middle School guides the learning experiences of 40 students per class in a team teaching environment. Students can choose which assignment to work on during a given class period. This method of teaching permits students to thoroughly investigate topics they find particularly interesting, while at the same time meeting a given objective on all hands-on learning projects.

The use of a non-linear approach to instruction creates a classroom environment based upon mutual trust and respect between students and teachers. In order for the class to operate efficiently, all students must be on task with one of up to 10 or more assignments being worked on by students at any given time (complex classroom interventions). What is often considered a chaotic classroom environment to the outside observer actually maximizes the amount of material investigated in the curriculum, as well as providing extensions of learning experiences. This learning environment has been recognized by the Idaho State Board of Education (Idaho’s Gold – aired 9/03) and NASA (NASA’s Brain

Bites) in the production of videos highlighting daily learning experiences linked to authentic experiences.

Key Contact Person:

Doug Walrath
Wood River Middle School
900 2nd Ave North
Hailey, ID 83333
Telephone: 208.788.3523
Email: dwalrath@blaineschools.org

Best Practice: *Practicum in Standards-Based Curriculum Development*

Best Practice Nominator: Steve Shumway

Description of Best Practice: In an attempt to better prepare pre-service technology teachers, faculty in the Technology Teacher Education Program at Brigham Young University have restructured pre-student teaching "practicum" experiences to include collaborative, standards-based curriculum development opportunities with local technology teachers. To implement this practicum component, university faculty contact 3-4 local middle school technology teachers each year regarding the possibility of university students working collaboratively with local teachers in developing and teaching a curricular unit in their classroom.

Using the *Standards for Technological Literacy* (STL), university students meet with the local technology teachers to determine what it is that students in a middle school technology class should know and be able to do as a result of having participated in a technology unit. University students then work in small groups to develop a curricular unit based on the chosen standards. University students consider assessments and instructional activities that allow middle school students to achieve the learning goals and then review the curricular unit with the local technology teacher. Local teachers share their expertise with the university students as to what concepts and instructional strategies might be most effective and then under the mentor teacher's supervision, the university students teach the unit.

As part of this activity, the pre-service teachers also complete a Teacher Work Sample (http://pirate.shu.edu/~devlinrb/portfolio/teacherworksample.html). Some positive outcomes of this "practicum" experience are that pre-service and local technology teachers become familiar with the need for standards and learn to develop curriculum based on STL. Additionally, pre-service teachers become more involved in earlier and more frequent teaching and curriculum development experiences and partnerships with teacher education institutions' personnel and local classroom technology teachers are strengthened. The biggest drawback to this approach is that it requires extensive planning and scheduling on the part of the university faculty and the local technology teachers.

Key Contact Persons:

Steve Shumway
Technology Teacher Education
Brigham Young University
Provo, UT 84602
Telephone: 801.422.6496
Email: Steve_shumway@byu.edu

Jared Berrett
Technology Teacher Education
Brigham Young University
Provo, UT 84602
Telephone: 801.422.6496
Email: jared_berrett@byu.edu

Best Practice: *Design Engineering*

Best Practice Nominator: Sharon A. Brusic

Description of Best Practice: The design process clearly weaves through every design engineering unit in the technology education class at Warwick High School. Each unit follows a similar structure with important concepts and skills presented for the first few weeks to build necessary background knowledge (including short, experiential activities and/or demos to better understand concepts), followed by an open-ended design problem for the latter part of the unit. The design challenge is always directly related to the unit theme (e.g., electronics, structures, mechanisms) and it is open-ended so that multiple solutions are possible. This process requires students to more narrowly define the problem and then use the technological problem-solving process to solve the problem. Working in small teams, students solve their problems and document the entire process in well-organized booklets (with sketches, text descriptions, and photos) that they compile and bind (comb binding).

In the electronics unit, for example, students with no prior knowledge or experience with electronics might go through several lecture/laboratory experiences to learn about basic circuit components and configurations (e.g., series, parallel, and combination circuits, resistors, integrated circuit chips). Then the instructor asks them to identify a problem that can be solved using electronics and provides students with additional resources (e.g., circuit schematic booklets) that they scour for information related to a specific problem they want to solve. Students generally use these schematics as starting points as they develop solutions for their problems which might include electronic games or light displays. As another example, students in the structures unit would first spend about two weeks learning about structural engineering concepts and conducting various experiments to explore stresses and loads. Then, students might solve an open-ended problem to design and build a cantilever structure, a cardboard chair that supports an average person, or some other structure problem. Whatever the nature of the unit, the focus remains on applying the technological design process and documenting that process in a professional manner. Assessments ensure that students think about important factors in design engineering such as function, aesthetics, structural integrity, ergonomics, etc. In addition, the instructor uses a creative group assessment process that requires team members to come to a consensus on individual grades based on perceived group contributions.

This teaching approach has many advantages. First, it provides a balance between the teaching of important concepts/skills through structured laboratory experiences and the application of concepts/skills through open-ended problem solving experiences. Second, the design problems facilitate a lot of creative problem solving that lets students pursue a specific area of interest or concern to them, thereby motivating them even more. Third, the engineering problems help students tie together technology, science, and math understandings in a meaningful way. And fourth, students document their entire problem solving process from identification of the problem through testing and evaluation. This approach provides a format to record and reflect upon the process – putting the emphasis on the process students pursued rather than the final product that results.

Key Contact Person:

Harold "Hal" Lefever
Warwick High School
301 S. Orange Street
Lititz, PA 17543
Telephone: 717.626.3734
Email: hlefever@warwick.k12.pa.us

Best Practice: *The Teacher Chronicles*

Best Practice Nominator: Marie Hoepfl

Description of Best Practice: In 2000, the International Technology Education Association (ITEA) initiated an online series that it called the "Teacher Chronicles" (http://www.iteaconnect.org/TeacherChronicles/teachchron.html). In this series, technology teachers were invited to write a series of journals describing their day-to-day experiences in the classroom. In Volume I (2000-2001), Gary Wynn of Indiana wrote 10 installments, each approximately 10 pages long. Gary described his relationships with students, his facility and laboratory equipment, his professional activities, and much more. Each installment also featured some personal reflections on particular challenges he had faced in the classroom, as well as news about his home life and how his teaching job affected his personal life. Readers were treated to a very engaging, intimate, and true-to-life perspective on the life of a teacher.

In subsequent years, the ITEA featured journals by Steve Meyer, a high school technology teacher in Wisconsin, Andy Stephenson of Kentucky, and Gregg Mervich of Georgia. Each of these classroom teachers provided his own unique reflections on teaching, yet each managed to convey a very real sense of the challenges and successes that are inherent in every teaching situation.

When I started teaching a new one-hour class at my university called *Introduction to the Technology Teaching Profession*, I could think of no better "textbook" than these vignettes into the lives of teachers who so openly shared their feelings about the experience of teaching technology education. Each installment contains rich discussion points that can be used to highlight what these prospective teachers (my students) might face themselves. Many of the teachers highlighted also serve as electronic role models for these university students. Although I supplement my students' required reading with many other resources, the Teacher Chronicles continues to be a featured part.

Unfortunately, the Teacher Chronicles was discontinued in 2004. Since that time, the ITEA has launched a new series called "Bright Ideas," available to members only. Bright Ideas features outstanding programs and information of interest, and is a helpful resource. I still continue to appreciate, however, having been invited into the minds of the teachers who wrote the Teacher Chronicles, and I know that my university students do, too.

Key Contact Person:

Katie de la Paz
International Technology Education Association
1914 Association Drive, Suite 201
Reston, VA 20191
Telephone: 703.860.2100
Email: kdelapaz@iteaconnect.org

Best Practice: *Continuing Professional Development Experiences*

Best Practice Nominator: Michael A. De Miranda

Description of Best Practice: In order to provide relevant and timely learning experiences for his students, Doug Walrath of Wood River Middle School immerses himself in authentic experiences during the summer and throughout the school year to stay current with emerging technologies and to develop working relationships to bring professional experiences into the classroom. An overview of professional development experiences from the past few years includes the following: NASA Educational Workshop (NEW 5-8) at Johnson Space Center, TX; Space Grant Consortium's "Have Spacesuit, Will Travel" workshop at Johnson Space Center, TX; and the Semiconductor and Equipment Materials International (SEMI) workshop in Tempe, AZ. Most recently Doug was selected as a finalist for the NASA Educator Astronaut position, class of 2004. This professional development experience has served as a catalyst for the infusion of many space related activities into Doug's classroom.

This best practice serves as the basis for an ongoing curriculum, which continually reinvents itself as technologies emerge and change with human wants and needs. A particular interest in Doug's classroom environment is a number of educational spin-offs of "real world" technologies developed from a working relationship with NASA. This partnership has resulted in the designing, building, and testing by students of Flight Simulators, Space Station Simulators, and wind tunnels. Most recently, he introduced an entirely new course titled "NASA TECH". Teacher and student interest in the technologies related to human space flight and exploration led to the development of this new course which uses the integration of technology, math, and science to investigate space related technologies.

In addition to the NASA-related technologies obvious to the casual visitor of Doug's classroom, he and his fellow technology teacher have also converted their black and white darkroom into a clean room environment as the technologies have changed over time from chemical-based photography to digital photography. The SEMI workshop that focuses on the manufacturing processes related to integrated circuitry provides a professional development experience in clean room technologies. Using clean room technology experiences as a background, his students now suit-up in clean room "bunny" suits, take an air shower in a secondary clean room, and then enter the main clean room to program robots to perform pick and place operations with dual in-line packages.

Students benefit from the hands-on learning experiences in designing, building, and testing projects that are a direct result of Doug's professional development activities with NASA and other workshops. In addition to the physical projects and activities, the experiences from each of these activities ignite the curriculum in his program. Relating classroom topics and activities to interactions with NASA astronauts, engineers, and technicians brings a new level of relevance to technology education subject matter.

Key Contact Person:

Doug Walrath
Wood River Middle School
900 2nd Ave North
Hailey, ID 83333
Telephone: 208.788.3523
Email: dwalrath@blaineschools.org