Pedagogical Guide: TECHknow Middle School Units

Agriculture and Biotechnology Challenge
Flight Challenge

Facilities: general description of the type of facility required to teach the unit. What is the ideal facility/lab?
The ideal facility or laboratory setting would be a combination of traditional and modular with work areas, benches, tools, and machinery available as well as computer stations, printers, and network access.

Equipment: general listing of the type of equipment needed to teach the unit.
Please see the specific lists already compiled in the TSA competitive events guide or Tech-know workbooks and teacher guides.

Teaching Skills/Methods: the general teaching methods that are used to teach the unit, tips from experienced teachers, how to encourage creativity/problem solving, the motivation of this approach, how to manage group instruction, what skills are needed to teach with design challenges in a standards-based program in technology education?
I think the teachers need to understand and teach basic problem solving steps and models, such as the DEAL (define, explore, act, look back). They can't give their students the answer or solutions each time the kids hit a wall or an obstacle in their problem solving. The instructor or advisor can't help the students in competition or in real life situations, so the only way the students will learn to solve their own problems is to start in the classroom. It is also essential that the teachers build the gliders, create the logs, make a display, or whatever else they want their students to do before expecting their students to do so.

Student Learning: specific examples of student success, anecdotal experiences, the educational benefit of this approach, what do students learn from design challenges and competition?
I have several young men and women who have been involved with field testing several of the Tech-know units, being members of TSA, and taking technology education classes throughout their middle and high school careers. They often talk about the f un they've had, but more importantly about the things they have learned along the way. They especially are impressed with the dedication and skills of their peers when we go to competitions. I think that being a part of TSA and Tech-know has given me the knowledge and opportunities to improve myself as a teacher and advisor.

I'll never forget the student who looked at me at the end of piloting the Ag & Biotech Unit and said, "Honest Ms. H. I thought I'd hate this stuff' It sounded weird. But I like it a lot! " She liked it so much that she recruited a friend to join TSA and do this event among several others. In fact, she and her partner are beginning their FIFTH year as TSA members and have experienced numerous successes at TSA regional, state, and national competition due in part to our involvement in Tech-know.

Over the years, I have had numerous special needs students who came to my classroom with a host of problems. No matter what their difficulties, my special students more often than not experience a high level of success with TSA and Tech-know-related activities. One young man in particular could seldom control his outbursts and constantly was moving around, even needing an assistant to follow him. Yet, when we began the Flight Unit he was mesmerized and sat still for thirty minutes watching a flight simulation and then designing and building the best glider in the class. His special needs teacher and mother even commented that all he talked about for weeks after was the work he did during that unit. For those days his outbursts were gone and his attention was focused. I thank all of you who have worked so hard perfecting these units for these wonderful experiences!

CyberSpace Pursuit

Description/Overview of the Unit:
This unit is designed to prepare students to create well-designed websites in order to compete in the TSA Cyberspace Pursuit Challenge. Students will learn about the history of the web, how to use search engines, proper organization of a webpage, how to optimize it, and meeting web standards compliance.

Facilities: general description of the type of facility required to teach the unit. What is the ideal facility/lab?
The ideal facility would have a computer for each student, or group, with a WYSIWYG HTML editor such as Dreamweaver or Frontpage. Students will also need access to web-based activities via a in-school network or over the web. It also would be good to have photo editing software, such as PhotoShop accessible to students.

Equipment: general listing of the type of equipment needed to teach the unit.
Each student, or group will need a computer with access to a local network or the internet.

Teaching Skills/Methods: the general teaching methods that are used to teach the unit, tips from experienced teachers, how to encourage creativity/problem solving, the motivation of this approach, how to manage group instruction, what skills are needed to teach with design challenges in a standards-based program in technology education?
Teachers should follow the lesson plans in the sequence provided in the teaching materials. To increase motivation, it may be a good idea to discuss with students what kinds of jobs are available to them once they graduate and compare them to the web jobs discussed in this unit.

Student Learning: specific examples of student success, anecdotal experiences, the educational benefit of this approach, what do students learn from design challenges and competition? I have not participated in the TSA competition, but I have seen a great improvement in enthusiasm, test scores and web design abilities since piloting this unit. The web sites that students have produced since this pilot have been way more organized, easier to use and visually stunning. I have had several students contact me a couple years after having my class and they have shown me some of the website they have done and I have been blown away by their progress. I wish I had something like this available to me when I was in school!

Digital Photography

Description/Overview of the Unit:
This unit is designed to teach students how to identify good photography when they see it and be able to apply basic principals of photography to improve their compositions. It also addresses ethical issues regarding photography and how to improve images with image editing software.

Facilities: general description of the type of facility required to teach the unit. What is the ideal facility/lab?
The ideal facility would have a computer for each student, or group, with photo editing software, such as Photoshop accessible to students.

Equipment: general listing of the type of equipment needed to teach the unit.
Each student, or group will need a computer with access to the internet. It would be ideal to have one digital camera per group, as well.

Teaching Skills/Methods: the general teaching methods that are used to teach the unit, tips from experienced teachers, how to encourage creativity/problem solving, the motivation of this approach, how to manage group instruction, what skills are needed to teach with design challenges in a standards-based program in technology education?
Teachers should follow the lesson plans in the sequence provided in the teaching materials. Students are usually pretty motivated when it comes to taking pictures. Use that motivation to gets students to take the reading assignments, quizzes and assignments serious. Offer individual photo shoots for students who achieve exceptional progress. These photos can then be used in a school publication such as a newspaper or yearbook.

Student Learning: specific examples of student success, anecdotal experiences, the educational benefit of this approach, what do students learn from design challenges and competition?
I have not participated in the TSA competition, but I have seen a great improvement in enthusiasm, test scores and photography skills since piloting this unit. The photos that students have produced since this pilot have demonstrated that they understand key elements like balance, filling the frame and the rule of thirds. I have had a couple students participate in photography competitions outside of my class and do quite well by applying the principals covered in this unit.

Dragster Design

Description/Overview of the Unit:
Dragster Design is the exploration of the Design Process, learning the basic principals of aerodynamic design, and Newton's Laws of Motion. The students are taught basic metric measuring skills. After the students cover the background information they learn how to brainstorm a design idea, they discuss the specifications for their design, the actual hands on creation of their design, and then they test their car design in actual class racing competition. Finally the students complete a feedback writing assignment on the unit, and complete an assessment on the design principals learned throughout the unit.

Facilities: general description of the type of facility required to teach the unit. What is the ideal facility/lab?
The Tech Lab facility should have a ventilated, dust controlled environment for cutting, sanding, painting and assembly of the C02 dragster. The facility should have a classroom area with a whiteboard for whole class instruction, a screen for viewing video's and a big enough area to set up the racetrack where the competition will be held.

The ideal facility would have all the above but the track area for the competition would be long enough to set up a track with the proper staging area, and a finish line apron with the track length to be 65 feet, as that is the official TSA scale quarter mile.

Equipment: general listing of the type of equipment needed to teach the unit.
Teaching equipment needed to properly equip the classroom/Lab would be the following: a VCR/DVD player, Video Projector, and screen speakers. A whiteboard should be in the classroom. The classroom should have a number of computers to provide student access to the internet and any curriculum.

To construct the C02 dragsters from wood blanks, the facility should have at least the following power tools: a band saw, combination belt/disc sander and drill press. This equipment should be in an area where sawdust can be controlled. A paint booth with power exhaust fan vented to the outside would be ideal for priming & painting the dragsters. Items for the students to hand finish their dragster would be a bench vise and hack saw to cut axle materials, hand files or wood rasps to help students shape their wood car bodies and various grits of sandpaper and foam sanding blocks to smooth the car bodies. Most important is a digital gram scale for students to weigh their car bodies to attain the lightest possible weight.

For the racing competition, you will need a racetrack and timing equipment, as it is impossible to judge a winner using the naked eye as the cars hit the finish line at too high a speed.

Optional equipment might include a wind tunnel equipped with a smoke machine to measure aerodynamic forces on the finished car bodies.

Teaching Skills/Methods: the general teaching methods that are used to teach the unit, tips from experienced teachers, how to encourage creativity/problem solving, the motivation of this approach, how to manage group instruction, what skills are needed to teach with design challenges in a standards-based program in technology education?
I prefer to use whole class teaching, that way as questions come up individually from students, the whole class can benefit by exploring solutions to a particular problem or question a student has-the whole class benefits! Students should be encouraged to use online recourses the teacher has posted on the computers for student use.

I give the students a background on aerodynamics through the curriculum itself, supplemented with video on aerodynamic race car design. I use actual student created racecars to model good and not so good designs for the class.

The driving force behind student motivation is the competitive nature of this unit. On day one of teaching the unit I show to the class the trophies presented to the winners of the competition. I have a trophy for the school champion from all my classes, then a class champion, then runner up. I let them know that one of them will be holding the trophy at the end of competition. For additional motivation, I also have a "Best In Show" award for those who want to compete for style instead of speed. The cars are judged by their peers in each class. I also encourage small groups to form racing teams like in the real racing world. Each team individual is responsible for their own car. Teams are encouraged to come up with a Team name as well.

It is very easy to manage group instruction, as all students know in advance, that sanctions include not getting to race their car in the big racing competition. All students seem to work toward the competition.
The teacher of this unit must provide the students a background in measurement skills-I always work in the metric as that reinforces Technology standards. The students are provided all TSA specifications they need to construct their cars. The teacher must reinforce the fact that students must adhere to the max & minimum specs on their cars or face disqualification as is done in the real racing world. The Science standards are met in this unit with the introduction of the laws of motion and aerodynamics. Language Arts standards are met with the students writing a final paper - feed back on what they learned in this unit, what did they like most/least?

Student Learning: specific examples of student success, anecdotal experiences, the educational benefit of this approach, what do students learn from design challenges and competition?
The driving force behind the unit is that students can take what they have learned from the standards based curriculum and construct a hands on model & test it, make any modifications needed, then race in the competitive event. Those students who have learned will have success in the race. This unit reaches across all sexes, all nationalities, all economic backgrounds; female students seem to take their time put a lot of car into their cars and do well.

After reading the many follow up essays written by my students, the majority find this one of the most exciting learning activities they have done in school! They learn many scientific principals, and have fun doing it!! I encourage parents of the students to become involved in this project and I invite all parents to the races to witness the "thrill of victory, or the agony of defeat" I take a photo of the student holding their car standing next to their parent and send it home as a race day souvenir. Also I video tape the race to show on the schools morning announcements -this lets the student body see what's happening in the Tech Lab. It helps sell my program to the student body.

Dragster Design

Description/Overview of the Unit:
Design, build and test a CO2 powered dragster to learn about fundamental science, math and technology concepts related to transportation systems and aerodynamics.

Facilities: general description of the type of facility required to teach the unit. What is the ideal facility/lab?
A general technology lab would be the best facility to implement this activity. A modular lab could pose some problems.

Equipment: general listing of the type of equipment needed to teach the unit.
Drafting equipment
Drill press
Band saw
Sanders- belt and disc
Shaping tools – files, rasp, dremel tool
Paint booth
Optional: milling machine, lathe, CNC

Teaching Skills/Methods: the general teaching methods that are used to teach the unit, tips from experienced teachers, how to encourage creativity/problem solving, the motivation of this approach, how to manage group instruction, what skills are needed to teach with design challenges in a standards-based program in technology education?
It is a good idea to have vehicles and drawings from previous years to show students.

Allow students to share ideas in the initial phases of the design process.

Student Learning: specific examples of student success, anecdotal experiences, the educational benefit of this approach, what do students learn from design challenges and competition?
Students will learn that a carefully though out design will lead to improved performance of their vehicle.

Environmental Challenge

Description/Overview of the Unit:
Identify and research an environmental problem that concerns your local school or community. Plan and implement a solution to that problem, then evaluate the results and communicate your solution through a display and demonstration.

Facilities: general description of the type of facility required to teach the unit. What is the ideal facility/lab?
The ideal laboratory to teach Environmental Challenge will have classroom space for the entire class, space for small group interactions, internet access, telephone access, and space for creating displays. The facility can be traditional or modular but needs to have dust producing machines to create solutions for identified environmental problems.

Equipment: general listing of the type of equipment needed to teach the unit.
Computer(s) with presentation capabilities
Internet access
Telephone access
Woodworking and Metalworking tools and machines

Teaching Skills/Methods: the general teaching methods that are used to teach the unit, tips from experienced teachers, how to encourage creativity/problem solving, the motivation of this approach, how to manage group instruction, what skills are needed to teach with design challenges in a standards-based program in technology education?

Utilize the text information to learn about Environmental Challenges. This takes time to read but it is valuable.

Capitalize upon the utilization of the Problem Solving Model to identify appropriate challenge, determine solutions, implement solutions and report the results. If the problem solving model us utilized on a regular basis then the students will be more apt to recognize the value and follow the steps.

Utilize parents and professionals in the community as resources to help scientifically identify environmental problems that are realistic for the students can attack. These same resource people can be of great value in helping to guide student through research and development.

Collect data for determining the problem and from implementing the solution.

Remember to ask the question frequently, "Are we solving the real problem or are we treating a symptom of a greater problem?"

Be willing to take time to solve the problem. You may have to begin the unit, go to another unit and return to the Environmental Challenge unit over the course of a semester or school year.

Student Learning: specific examples of student success, anecdotal experiences, the educational benefit of this approach, what do students learn from design challenges and competition?

Students learn about the conflict of human's technology with the environment. They learn that the environment is fragile and human life is jeopardized by human's use of technology.

Students learn that many environmental challenges have solutions while many do not at present. It is the responsibility of all to create solution to these problems.

Students learn about the Three R's. Hopefully they learn to think differently about the environment.

Students learn about research and reporting results. They learn about problem identification and problem solving.