Project Goals

• Conceptualize and develop curriculum materials for advanced level high school technology education students.

• Prepare students for post-secondary education in engineering or advanced level technical programs at the community college level.
History of Project ProBase

- National Science Foundation (ATE)
- A Consortium of Community Colleges
- Project funded for three years
- One year of curriculum development completed
- Finished product in 2005
Rationale for the Project

- The Need for advanced-level high school curriculum materials
- Current emphasis on preparation for engineering and advanced level technical education
- Need for Standards-based Curriculum materials
Guiding Principles/Outcomes

- Problem-based Learning
- Constructivist Approach
- Standards-based
- Sound Curriculum Design
- Bridge Competencies
- Eight Learning Units
Knowledge Base

• **Understanding by Design**
  (Wiggins and McTighe)
  - Identifying “enduring understandings”
  • Large, inclusive, and robust ideas.
  • Ideas often misunderstood
  • Ideas central to the discipline
  • Important ideas worth knowing
Identifying Enduring Understandings

Is the concept something important to know as an adult?

Does it reside at the heart of the discipline?

Does it require uncoverage?

Does it offer potential for engaging students?

Enduring Understandings

Wiggins & McTighe, 1998
Enduring Understanding 1

- Technological progression is driven by a number of factors, including individual creativity, product and systems innovation, and human wants and needs.

Enduring Understanding 2

- Technological development for the solution of a problem in one context can spin-off for use in a variety of often unrelated applications.
Enduring Understanding 3

- Technological change can be positive and/or negative, and can have intended and/or unforeseen social, cultural, environmental, and existential consequences.

Enduring Understanding 4

- Technology is made up of systems and subsystems that fit into larger technological, economic, and social systems.
Enduring Understanding 5

- There are compelling and controversial issues associated with the acquisition, development, use, and disposal of resources.

Enduring Understanding 6

- Technological design involves tradeoffs among competing constraints and requirements.
Enduring Understanding 7

- Technological design is a systematic process used to *initiate and refine ideas*, solve problems, and maintain products and systems.

Enduring Understanding 8

- Individuals should know how to *evaluate the benefits, limitations, and risks* associated with existing and proposed technologies.
Enduring Understanding 9

- Technology requires the acquisition of the knowledge needed to *use and operate* various technological devices and systems.
Knowledge Base

In Backwards Design...

We must clarify the results we seek & the evidence we will use before designing lessons & developing activities
Knowledge Base

- Decide on the evidence that will be used to make judgments about whether the “enduring understandings” have been met.

How will you know whether the students have achieved?
Knowledge Base

- What *assessments* will be used to make judgments about student understandings of the enduring understandings?

  - Short-term assessments, checks for understanding, academic prompts, comprehensive & performance assessments.
Knowledge Base

After the “enduring understandings” & assessments have been developed...

It is time to develop learning activities.

Too often, we start with activities.
The ProBase Curriculum is created using a “backwards” design model.

Distill Enduring Understandings from STL
Establish Essential Questions
Identify Bridge Competencies
Develop Learning Units

<table>
<thead>
<tr>
<th>Identify Desired Results</th>
<th>Determine Acceptable Evidence</th>
<th>Generate Learning Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enduring Understandings</strong></td>
<td>~ Primary Challenge</td>
<td>~ Concepts</td>
</tr>
<tr>
<td>What will students understand as</td>
<td>~ Summative Assessment</td>
<td>~ Skills</td>
</tr>
<tr>
<td>a result of this Learning Unit?</td>
<td>~ Learning Cycle Assessment</td>
<td>~ Bridge Competencies</td>
</tr>
<tr>
<td>2-3 per Learning Unit</td>
<td>~ Inventor’s Logbook</td>
<td>~ Activities</td>
</tr>
<tr>
<td><strong>Essential Questions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What questions will focus this</td>
<td></td>
<td></td>
</tr>
<tr>
<td>learning unit?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-12 per Learning Unit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bridge Competencies
Curriculum Delivery Tools

- Learning units revolve around a robust primary challenge
  - Supported by four-phase learning cycles
    - Exploration
    - Reflection
    - Engagement
    - Expansion
Learning Units Under Development
Energy & Power Technologies

The relationship between energy and power technologies and all other technologies, and how modern energy and power systems impact cultures, societies, and the environment. An examination of how energy and power systems can be made more efficient and how they may be utilized in problem solving.

Undergoing Pilot-testing: Spring 2004

Information & Communication Technologies

An examination of how technology facilitates the gathering, manipulation, storage, and transmission of data, and how this data can be used to create useful products. Developing communications systems that can solve technological problems.

Transportation Technologies

The complex networks of interconnected subsystems that each transportation system comprises and the roles of these components in the overall functional process of the system. An analysis of the improvements and the impacts of transportation technologies on the environment, society, and culture.

Manufacturing Technologies

The advances that maintain manufacturing efficiency, how human consumption affects manufacturing and how manufacturing affects the standard of living of various peoples. Processing and changing raw materials to produce more desirable products.

Pilot-tested, Fall 2003. Undergoing revision, Spring 2004

Being Prepared for Pilot-testing: Spring 2004
Construction Technologies

An examination of the factors influencing the design and construction of permanent and semi-permanent structures, the practices related to construction maintenance, alteration, and renovation, and the functions of the primary systems installed in those structures.

Curriculum Development: Summer 2004

Medical Technologies

An analysis of how medical technologies are used to increase the quality and length of human life, and how increased use of technology carries potential consequences, which require public debate. The tools and devices used to repair and replace organs, prevent disease, and rehabilitate the human body.

Curriculum Development: Summer 2004
Agriculture & Related Biotechnologies

A study examining how agricultural technologies provide increased crop yields and allow adaptation to changing and harsh environments, enabling the growth of plants and animals for various uses. Analysis of the various uses of biotechnology and the ethical considerations of those uses.

Curriculum Development: Summer 2004

Entertainment & Recreation Technologies

A study of technological entertainment and recreation systems, with an examination of the differences between these technologies, of how their use enhances human leisure-time performance, and of the social, cultural, and environmental implications of their usage.

Undergoing Final Revision for Publication: Summer 2005
Curriculum Development Process

- Developing the Knowledge Base
- Hosting the Writer’s Symposium
- Developing Curriculum Specifications
- Making Curriculum Revisions
- Conducting Pilot/Field-testing
- Conducting Additional Revisions
- Publishing/Distributing
- Conducting Teacher Training
Summer Curriculum Writer’s Symposium

- 2 weeks of intensive work!
- 4 writing teams (one per learning unit)
- 4 members per team
- Representatives from math/science
- National representation
- Consultants (community college and state departments)
Pilot- and Field-test Sites

Palm Bay High School (Florida)
Berea High School (Kentucky)
Neuqua Valley High School (Illinois)
University High School (Illinois)
The Conserve School (Wisconsin)
Pilot- and Field-tests

- Conducted in diverse programs and geographic locations
- Deployed with real students in real classrooms & labs
- Represented a broad spectrum of program and ability levels
- Regular weekly debriefing sessions with teachers
- Site visits, student debriefings & surveys
- Most important...careful and thorough notes (ideas, problems, edits, suggestions)
Sample Materials

Instructor & Student Guides
## The Planning Calendar

### Entertainment & Recreation Learning Unit Calendar

<table>
<thead>
<tr>
<th>Week</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction; Preliminary Challenge</td>
<td>Preliminary Challenge</td>
<td>Preliminary Challenge</td>
<td>Preliminary Challenge</td>
<td>Introduce Primary Challenge; Ending, Understanding</td>
</tr>
<tr>
<td>2</td>
<td>Primary Challenge</td>
<td>Learning Cycle 1</td>
<td>Learning Cycle 1</td>
<td>Learning Cycle 1</td>
<td>Learning Cycle 1</td>
</tr>
<tr>
<td>3</td>
<td>Learning Cycle 1</td>
<td>Learning Cycle 1</td>
<td>Learning Cycle 2</td>
<td>Learning Cycle 2</td>
<td>Learning Cycle 2</td>
</tr>
<tr>
<td>4</td>
<td>Learning Cycle 2</td>
<td>Learning Cycle 2</td>
<td>Learning Cycle 2</td>
<td>Learning Cycle 3</td>
<td>Learning Cycle 3</td>
</tr>
<tr>
<td>5</td>
<td>Learning Cycle 3</td>
<td>Learning Cycle 3</td>
<td>Preparing for the Primary Challenge</td>
<td>Learning Cycle 4</td>
<td>Learning Cycle 1</td>
</tr>
<tr>
<td>6</td>
<td>Learning Cycle 4</td>
<td>Learning Cycle 4</td>
<td>Learning Cycle 4</td>
<td>Learning Cycle 4</td>
<td>Learning Cycle 4</td>
</tr>
<tr>
<td>7</td>
<td>Learning Cycle 4</td>
<td>Learning Cycle 4</td>
<td>Learning Cycle 5</td>
<td>Learning Cycle 5</td>
<td>Learning Cycle 5</td>
</tr>
<tr>
<td>8</td>
<td>Learning Cycle 5</td>
<td>Learning Cycle 5</td>
<td>Preparing for the Primary Challenge: Musical Score</td>
<td>Primary Challenge</td>
<td>Primary Challenge</td>
</tr>
<tr>
<td>9</td>
<td>Primary Challenge</td>
<td>Primary Challenge</td>
<td>Primary Challenge</td>
<td>Primary Challenge</td>
<td>Primary Challenge</td>
</tr>
</tbody>
</table>
### Materials Lists

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Qty</th>
<th>Notes and Recommended Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio Monitor Kit</td>
<td>14</td>
<td>N/A</td>
</tr>
<tr>
<td>600 Watt Mono PA Speaker</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 4” x 4” wood dowel</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 1/2” PVC Tees</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 4” x 8” x 1/4” plywood</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 8” x 2” x 3” Board</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Steel Strip 1 1/2” wide by 8” long</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Package of Weather stripping</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Threshold strip (width can vary)</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 2” x 2” x 3” Electrical Conduit</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Roll of String</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>N/A Misc. hardware, metal and plastic</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>N/A Wood fasteners</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Package of 25’ insulated wire sheath wire</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>2 5 pound weights</td>
<td>2</td>
<td>N/A</td>
</tr>
<tr>
<td>2 10 pound weights</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 20 pound weight</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Themed head poster</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Shoelace 3/8” wide</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 Large Panel with approximately 1/2” gasket</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 1/8” Vary tubing</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>1 1 1/2” PVC elbow</td>
<td>1</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Concept Maps

Entertainment and Recreation Technologies
Learning Unit Concept Map
Explicit Connections

Entertainment and Recreation Technologies Overview

Up to this point, we have been discussing the Project Promise Learning Units in general terms. The following points will be specific to Entertainment and Recreation Technologies.

Enduring Understandings and Essential Questions

The Entertainment and Recreation Technologies Learning Unit focuses on four of Sweden's core technologies as they compete and develop. Entertainment and Recreation Technologies offer students real-world applications. We will address the following points:

1. that technological progression is driven by a number of factors, including technological continuity, product and process innovation, and human wants and needs
2. how technological systems work, the components of these systems, and how they fit into the larger technological, economic, and social systems
3. how technological assessment is used to determine the benefits, limitations, and risks associated with existing and proposed technologies
4. how technology development is a series of simple and complex technologies

The essential questions addressed in each learning cycle will be reflected in the learning cycle objectives.
Teaching Tips

Engagement

GPS Treasure Hunt

The objectives of this activity are to determine coordinates of specific locations on a map and use them to locate the "treasure." The activity requires students to navigate through a series of steps, each consisting of determining coordinates and moving to the corresponding location. The "treasure" is hidden at one of the locations, and students must follow the correct sequence to find it.

Teaching

1. As a supplement to this activity, you will need to
   a. determine the coordinates of the specific locations
   b. place the "treasure" at the last location

   Students will need to:
   - Determine the coordinates of the locations
   - Use the GPS to locate the "treasure" at each step
   - Determine the correct sequence of locations

   The "treasure" is hidden at one of the locations, and students must follow the correct sequence to find it.

   The GPS units have a margin of error, and the instructor can adjust the margin to ensure that all students can participate.

   The instructor should ensure that all students have access to the GPS units and that they are able to follow the instructions.
**Improved Rubrics**

<table>
<thead>
<tr>
<th>Element</th>
<th>Grading Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Boat Measuring Devices</td>
<td>Demonstrated complete understanding of the proper use of measuring devices</td>
</tr>
<tr>
<td>Mathematical Competence</td>
<td>Demonstrated complete understanding of the proper mathematical formulas</td>
</tr>
<tr>
<td>Immoral Logical Analysis</td>
<td>Fully identifies and comprehends the testable component while designing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Boat Measuring Devices</td>
<td>Demonstrated complete understanding of the proper use of measuring devices</td>
<td></td>
<td></td>
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</tr>
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<td>Mathematical Competence</td>
<td>Demonstrated complete understanding of the proper mathematical formulas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immoral Logical Analysis</td>
<td>Identifies and comprehends the testable component while designing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does not identify or comprehends the testable component while designing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Score
Inventor's Logbook

Respond to the following in your Inventor's Logbook:

- Describe two ways in which the availability of materials has changed the evolution of video game devices.
- Based on your observations of your Video Genie, make a prediction of what a video device might be like in the year 2050.
- As a consumer, what technological developments in entertainment and recreation devices would you like to see?

Preparing for the Challenge

Plot the steps your team would take based on your understanding of hydroelectric power generation and create a team concept map that accurately reflects your team's knowledge structure at this time. Create your team's concept map on a large sheet of paper so that you can add to it as your knowledge grows.

Use the Inventor's Logbook 12 spaces below to record a personal copy of your team's map so that you can reference it as needed.
Preliminary Challenges
Primary Challenges
Learning Cycles