A Changing Economy

To Earn A Living Wage, Our Students Will Need a Different Skill Set

Source: Linda Darling-Hammond

- **Low Skill Jobs**
- **Knowledge Work Jobs**
Why the Need for PBL? Let’s look at Education for the 20th Century

- Traditional approaches are not designed to prepare all students for college and work.

- NCLB - Raising standards through high stakes tests is causing many teachers to rely on some of the poorest teaching strategies.

- The business community has been telling us for more than a decade (SCANS-1992) that schools are not emphasizing the skills required for living wages.
Improving high schools requires the nation to redefine “rigor” to encompass not just mastery of core academic subjects, but also mastery of 21st century skills and content. Rigor must reflect all the results that matter for all high school graduates today. Today’s graduates need to be critical thinkers, problem solvers and effective communicators who are proficient in both core subjects and new, 21st century content and skills.

-- March 24, 2006

http://www.21stcenturyskills.org/
The Idea of Rigorous vs. Hard Learning

<table>
<thead>
<tr>
<th>Rigorous</th>
<th>Hard</th>
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</thead>
<tbody>
<tr>
<td>Students use knowledge and skills to perform authentic work in the discipline.</td>
<td>Learning includes extensive memorization of facts, details, or text.</td>
</tr>
<tr>
<td>Curriculum and instruction focus on conceptual understanding.</td>
<td>Curriculum and instruction focus on isolated facts and information.</td>
</tr>
<tr>
<td>Teachers connect knowledge and skills to students’ lives or interests.</td>
<td>Learning experiences are characterized by the irrelevance of the knowledge or skills.</td>
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What's holding us up??
Intro to PBL

- BIE Introduction to PBL
Intro to PBL
Traditional Classroom vs. PBL Classroom

THE OLD CLASSROOM

• Information is scarce, filtered and provided by the teacher and textbook
• Student memorize and are seldom asked to create or problem solve
• Learning is not related to other content areas or the real world
• Students work primarily alone
• Student feedback is minimal and not geared toward improvement

21st CENTURY CLASSROOM

• Unfiltered information is abundant and accessible from many sources
• Student is engaged in content based problems and projects
• Content is integrated with other subjects and real world issues
• Student feedback is detailed and used for improvement
• Student is expected to work with others
What Does PBL Look Like?

Teachers develop problems based on content standards that students, working in teams, develop solutions to. Teachers provide coaching, assignments and direct instruction to address student needs.
**Projects:** Large activities completed after the students have been pushed through homework assignments, lectures, and readings. Usually a culminating event for a unit or semester.
**PBL vs. Doing Projects**

**PBL:** Students are pulled through the curriculum by a driving question or realistic problem that provides a “need to know”. Lectures, readings, and skill building are integrated into the problem as the students need the information.
Students Talk about PBL
5 Steps for Designing a PBL Unit

1. Begin with the end in mind
2. Craft the Driving Question
3. Plan the Assessment
4. Map the Project
5. Manage the Process
### Step 1 – Begin with the End in Mind

#### Content Standards (TEKS)

- **(G.7A)** Students use one- and two-dimensional coordinate systems to represent points, lines, rays, line segments, and figures.
- **(G.7B)** Students use slope and equations of lines to investigate geometric relationships, including parallel lines, perpendicular lines, and special segments of triangles and other polygons.
- **(G.7C)** Students derive and use formulas involving length, slope, and midpoint.
- **(G.9A)** Students formulate and test conjectures about the properties of parallel and perpendicular lines based on explorations and concrete models.

#### Learning Outcomes

- **Active Collaboration** (Ability to work in groups)
- **Content Skills and Knowledge** (Distance, Midpoint, Parallel & Perpendicular Lines)
- **Critical Thinking and Problem Solving** (Effects of building a transit station in certain location and why - traffic, commuters, population, etc)
- **Presentation Skills** (Power point of Proposal)
- **Research Skills** (Population density, Traffic, Commuters, Popular Dallas Employees around area and future transit locations)
- **Technology Skills** (Formulas in Excel and utilizing power points features)
- **Work Ethic and Effort** (Ability to complete project components on time)
Step 2- Develop a Driving Question and Create an Entry Document

Driving Question:

How can learners create a railway system that reduces traffic congestion and population needs while keeping the distances at a reasonable length?
Driving Questions Are…. 

- Provocative
- Open-Ended
- Aligned to State Standards (TEKS)
- Challenging to Learners
- Arise from Real World Situations
- Act as a “Lighthouse” to Keep Learners (and the teacher) on course
Develop a Problem Statement:

Problem Statement:

How can we create a railway system that reduces traffic congestion and population needs while keeping the distances at a reasonable length?
Problem Statements

• Notice any trends in the problem statements on the previous slides?

  • **How can we as**… [role]
  • **Do**… [task]
  • **So that**… [purpose]

• What is the role of a problem statement in a project?
  • Formative assessment of students’ understanding of the project
The Entry Document

The Cities of Carrollton and Farmers Branch passed a bond in September 2007, giving millions of dollars for a light rail system to be implemented in 2010. The goal of this light rail system is to reduce the amount of traffic on Carrollton-Farmers Branch roads connecting to downtown Dallas, particularly during rush hour. The Cities of Carrollton and Farmers Branch would like your input on how to create a system of light rail that not only reduces the traffic, but does so in a cost efficient way. The bond package has generated enough resources for up to 7 transit stations or intersections. You will be submitting a proposal suggesting where the stations should be implemented. To do this, you must create a coordinate grid for a map of Carrollton and Farmers Branch to Downtown Dallas. You will need to analyze population density, traffic flow during rush hour, and commute time to determine where the stations should be built.

Your team will be using Microsoft Excel to develop a program that will calculate the distance from various Carrollton-Farmers Branch businesses and Dallas attractions, one point to another, using the light rail system. Also, it should contain a generic distance finding feature in which it can calculate the direct distance between any two points on the coordinate map of Carrollton-Farmers Branch you create.

Your proposal should include the equations of lines for the light rail system, as well as surrounding roadways (Major highways and crossing streets).

You will be presenting this proposal in three weeks.

Sincerely,

The DART Board of Directors
Define Group Roles

- **Chief Engineer** – Chief Engineers are similar to the team leader or teacher liaison. He/she will determine where the transit stations are to be built by analyzing all data. He/she will be in charge of collaborating with team members to prepare them for presentations. He/she will follow the expectations of the rubric for the presentations and for the project. He/she will also practice with each of his/her team members so that everyone is prepared for presentations and understand the concepts behind building their transit stations in the 7 locations.

- **Cartographer** - Cartographers will be in charge of interpreting all of the creating the coordinate system for the area. He/she will be in charge of plotting where the transit stations are placed. He/she will develop a scale system for the map and name all locations. He/she will also analyze all population and transportation maps. He/she will report conclusions to the Chief Engineer. He/she will make sure that the map follows the expectations of the rubric and that all work is as neat and professional as.

- **Mathematician** – Mathematics will be in charge of calculating the distance and midpoint of each point. He/she will create an Excel program to calculate these lengths. He/she will also work with the Cartographer to develop equations of lines for all the major highways and intersections around the transit system. He/she will make sure that the math follows the expectations of the rubric and that the work is accurate. He/she will need to be able to explain the mathematical thought process behind the Excel formulas.
**Develop a List of “Knows” and “Need to Knows”**

<table>
<thead>
<tr>
<th>We know…</th>
<th>We need to know…</th>
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</thead>
<tbody>
<tr>
<td>• Giving proposal of light rail line</td>
<td>• What is an equation of a line?</td>
</tr>
<tr>
<td>• Must determine where to build stations</td>
<td>• How do we make a coordinate grid?</td>
</tr>
<tr>
<td>• Make a coordinate grid of CFB to Downtown Dallas</td>
<td>• How do we analyze population density, traffic flow and commute time?</td>
</tr>
<tr>
<td>• Due in 3 weeks</td>
<td>• How do we use Microsoft Excel?</td>
</tr>
<tr>
<td>• Will be using Microsoft Excel</td>
<td>• How do we make a generic distance feature?</td>
</tr>
<tr>
<td>• Will be calculating distance and midpoint between points</td>
<td>• How do we find the distance?</td>
</tr>
<tr>
<td>• Can build up to 7 stations</td>
<td>• Do we take into account future development?</td>
</tr>
<tr>
<td>• Analyzing population density, traffic flow, and commute time</td>
<td>• What is the speed of the light rail system?</td>
</tr>
<tr>
<td>• Want to reduce traffic on major highways and intersections</td>
<td>• Can we put stations where they are proposed now?</td>
</tr>
<tr>
<td>• Excel program must have generic distance feature</td>
<td>• Is a model needed?</td>
</tr>
<tr>
<td>• It must be cost efficient</td>
<td>• Do we have a budget?</td>
</tr>
<tr>
<td></td>
<td>• What major highways and intersections are around the transit line?</td>
</tr>
</tbody>
</table>
### Step 3 – Plan the Assessment (Rubric Development)

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>UNSATISFACTORY (Below Performance Standards)</th>
<th>PROFICIENT (Minimal Criteria)</th>
<th>ADVANCED (Demonstrates Exceptional Performance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map of Area</td>
<td>- Map does not have appropriately labeled grid system</td>
<td>- Map includes properly labeled grid system</td>
<td>- In addition to meeting the PROFICIENT criteria...</td>
</tr>
<tr>
<td></td>
<td>- Map does not include scale</td>
<td>- Map includes a scale</td>
<td>- Multiple maps are provided, showing in an appropriate area with multiple transit lines.</td>
</tr>
<tr>
<td></td>
<td>- Map does not include 7 properly labeled coordinates that indicate transit lines</td>
<td>- Map includes all lines connecting the transit lines</td>
<td>- Map includes distances and lines between transit lines (may be on a separate sheet or Excel program).</td>
</tr>
<tr>
<td></td>
<td>- Map is small and difficult to interpret</td>
<td>- Map includes all lines connecting the transit lines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Transit routes have no orienting lines of identification</td>
<td>- Map is large enough and easy to read</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Motorways and intersections are not clearly labeled</td>
<td>- Motorways and intersections have correct labeling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Motorways and intersections do not have equations other labeled sections are incorrect</td>
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| Excel Spreadsheet      | - Spreadsheet does not contain 7 transition locations                                                          | - Spreadsheet contains 7 transition locations                                                | - In addition to meeting the PROFICIENT criteria...                                                          |
|                        | - Incorrectly or not calculable the distance between the relevant lines                                         | - Correctly calculates the distance between the relevant lines                              | - Multiple maps are provided, showing in an appropriate area with multiple transit lines.                  |
|                        | - Coordinates are not labeled correctly or not labeled at all                                                   | - Coordinates are labeled correctly and match up with map                                   | - Map includes distances and lines between transit lines (may be on a separate sheet or Excel program).   |
|                        | - Does not include any block on the printout / coordinates                                                    | - Includes program for the user to input two coordinates and correctly calculates them.    |                                                                                                              |
|                        | - Units are not correctly labeled                                                                                | - Units are correctly displayed                                                              |                                                                                                              |
|                        | - Spreadsheet is not clearly organized or easy to use                                                          | - Spreadsheet is clearly organized and easy to use                                          |                                                                                                              |

| Proposal (Power Point Presentation) | - Presentation includes a description of the proposal                                                        | - Presentation includes a long case for the proposal                                         | - In addition to meeting the PROFICIENT criteria...                                                          |
|                                    | - Presentation does not sufficiently explain the need for lighting in the area chosen                           | - Presentation sufficiently explains the need for lighting in the area chosen                | - Multiple maps are provided, showing in an appropriate area with multiple transit lines.                  |
|                                    | - Presentation does not utilize demographic data and/or did not research related transit link.                 | - Presentation utilizes demographic data provided and research related transit link.         | - Map includes distances and lines between transit lines (may be on a separate sheet or Excel program).   |
|                                    | - Presentation includes any of the required materials, shop, coordinates, distance calculations, graph, etc.  | - Presentation includes all the required materials, shop, coordinates, distance calculations, graph, etc. |                                                                                                              |
|                                    | - Presentation was not engaging or creative                                                                    | - Presentation was engaging or creative                                                      |                                                                                                              |

|                        | 0 - 14                                                        | 15 - 20                                        | 21 - 25                                        | 26 - 30                                                      | 31 - 35                                                      |
Step 4 – Map the Project

Sample Scaffolding Activities:

1. Journals (DART Research, Distance Practice, etc)

2. Workshops (Distance/Midpoint/Parallel and Perpendicular Lines/Excel Formulas/Population Density)

3. Homework

4. Quiz/Tests
Step 5 – Manage the Process

- What is the role of the teacher during the project?

- What is the role of the students during the project?

- What are the different stages of the project?

- What does a typical day look like?
New Roles for Everyone

Teacher
- Project manager
- Coach
- Guide
- Advisor
- Mentor

Students
- Team members
- Active learners
- Researchers
- Investigators
- Apprentice

Teachers and students are working collaboratively to complete the task.
## Stages of a Project:

<table>
<thead>
<tr>
<th>Beginning Stage</th>
<th>Middle Stage</th>
<th>Final Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Read entry doc and create know/need to know list</td>
<td>• Group meetings / progress checks using pacing chart</td>
<td>• Rough drafts</td>
</tr>
<tr>
<td>• Problem statement development / prioritize tasks</td>
<td>• Research</td>
<td>• Peer reviews</td>
</tr>
<tr>
<td>• Establish group roles and write group contracts</td>
<td>• Warm-ups / Journals</td>
<td>• Self evaluations</td>
</tr>
<tr>
<td>• Review rubric and fill out project pacing chart</td>
<td>• Class discussions</td>
<td>• Practice presentations</td>
</tr>
<tr>
<td>• Begin preliminary investigations</td>
<td>• Workshops and mini-lessons</td>
<td>• Presentations</td>
</tr>
<tr>
<td></td>
<td>• Reading assignments / skill building practice</td>
<td>• Practice tests</td>
</tr>
<tr>
<td></td>
<td>• Guided activities</td>
<td>• Tests</td>
</tr>
<tr>
<td></td>
<td>• Quizzes</td>
<td>• Collaboration evaluations</td>
</tr>
<tr>
<td></td>
<td>• Collaboration evaluations</td>
<td>• Reflection and debrief</td>
</tr>
<tr>
<td></td>
<td>• Rough drafts</td>
<td></td>
</tr>
</tbody>
</table>
A Day-to-Day Look at a Project:

Project Calendar
Day 1: Project Launch
Entry Document
Map of Dallas County
Population Density
Transportation Map
Knows/Need to Knows
Contracts

Day 2:
Revise Contract
Project Timeline/Tasklist
Research existing DART Rail Systems

Day 3: Coordinate System and Points
Create coordinate system on Map and find coordinates of 7 transit stations
→ Must be done electronically
→ Work on justification of each of the 7 transit stations
   → Description of reasoning/surrounding population or traffic
   → Name and Label for each Station (May be on Map)
Workshop: Excel Basics
Pajadough Activity: Coordinate System

Day 4: Distance Formula
Journal: Using Excel
Workshop: Deriving the Distance Formula Practice Problems: Distance Formula
Homework #1

Day 5: Midpoint Formula
Journal: Review of Distance Formula
Workshop: Deriving Midpoint Formula
Work on Project
→ Distances of each stretch of Rail Line calculated
→ Excel spreadsheet that calculates the distance between two points
Homework #2

Day 6: Peer Evaluations
Peer Evaluations
Quiz: Distance and Midpoint Formula
Work on Project
→ Midpoints of each stretch of Rail Line calculated
→ Excel spreadsheet that calculates the distance between two points

Day 7: Slope and Equations of Lines
Journal: Review of Midpoint Formula
Workshop: Slope and Equations of Lines
Work on Project
Homework #3

Day 8: Parallel and Perpendicular Lines
Journal: Review of Slope and Equations
Workshop: Parallel and Perpendicular Lines
Work on Project
Homework #4

Day 9: Work Day
Work on Project
Workshop: Presentation Skills for Expert Panel

Day 10: Project Wrap Up
Work on Project
Review Entry Document and Project Tasklist

Day 11: Geometry Presentations
Presentations to Expert Panel

Day 12: Review
Peer Evaluations
Project Evaluations
Test Review

Day 13: Geometry Test
TEST
Students Talk about PBL
Questions?
What it Actually Looks Like