Welcome to “Problem/Project-based Learning”

Introduction

Everytime I see a math word problem it looks like this:

If I have 10 ice cubes and you have 11 apples.
How many pancakes will fit on the roof?

Answer:
Purple because aliens don’t wear hats.
Getting Around

Navigation

The NAVIGATION area will allow you to easily select an appropriate section for study or review as well as move easily within the module itself.

TIPS

The TIPS area will include helpful tips, links and other information directly related to the screen you are working on during the learning tutorial.

Resources

The RESOURCES area will take you directly to additional practice items, examples and job aids for further development.
Dear Colleague,

This tutorial is designed and developed for teachers and practitioners who are interested in designing and developing curriculum that uses Problem Based Learning (PBL) methodology as its core curriculum development. Some of the most successful implementations of PBL have employed PBL throughout an entire curriculum, enabling students to develop the study strategies and self-regulation skills necessary for success in a PBL environment.

The tutorial consists of five modules. Each module has four primary sections:
• Pre-tutorial questions
• Explanation of a specific PBL principle
• Short exercises
• Post-questions
• Job aids
Modules’ Highlights

• For each module both the "Pre-Tutorial" and "Post-Tutorial" quiz will help focus your understanding of the subject matter before and after you have completed the module.

• Both the "Explanation" and “Exercises" parts will provide fundamental knowledge about PBL and “Exercises" will help you test your understanding throughout the module.

• Available “Job Aids” consists of steps and procedures that you may need to assist you in developing your own project/problem/based learning environment.

Please start the module by selecting the "Pre-Tutorial" button on the navigation bar to the left or by clicking the “next arrow".
Module Objectives

By the end of this module you should have:

• An understanding what Squeak Etoys is and how it can be used as a simulation and modeling tool
• Basic understanding of the characteristics of problem based learning
• How Squeak Etoys and Problem based learning address Common Core Mathematical Practices and Mathematics Content Standards
By the end of this section you will know:

- What Squeak Etoys is
- Why you should use Squeak Etoys
What is Squeak Etoys?

A. An educational game for children.
B. An educational tool for teaching children.
C. A set of building materials used for teaching children.
D. Software used to help children understand correct noises of animals

B is the correct response
What can users do in Squeak Etoys?

A. Construct models out of building materials.
B. Create games for children.
C. Create hands on models or simulations.
D. Simulate moving patterns to allow users to see moving parts.

C is the correct response.
Are basic programming skills required?

A. Yes
B. No

B is the correct response
Which of the following would be an example of using Squeak Etoys as a problem-based activity?

A. Blah
B. Blah
C. Blah
D. Blah

A is the correct response
What is Squeak Etoys?
• Educational tool for teaching children
• Open source media authoring environment
• Users create their own models and simulations
• Tile-based scripting environment
• No programming skills needed to manipulate objects
• Easily supported on basic computer software
• Enhances appeal of experimentation through its multimedia capabilities
Squeak Etoys: Why

Build models using technology

Allows students to use the technology as an alternative to building physical models
Squeak Etoys: Why

Safety

Students can investigate different phenomena without conventional laboratory hazards
Squeak Etoys: Why

Leads to inquiry-based investigation because models can be easily changed
Squeak Etoys: Why

Relates to the Common Core

Allows students to use technology as a key element in integrating Science, Engineering and Mathematics.
Squeak Etoys: Creating a Project

Representation in software of an artifact
Squeak Etoys: Creating a Project

Objects to think with

- Experimentation
- Visualize and explore new ideas

Sample objects
- Ellipse
- Rectangle
- Line
- Polygon

Source: http://www.squeakland.org/about/intro
Squeak Etoys: Creating a Project

**Sketching and Scripting**

- Draw sketches
- Write scripts
- Create digital books

Source: [http://www.squeakland.org/about/intro](http://www.squeakland.org/about/intro)
Squeak Etoys: Creating a Project

**Computer Fluency**

- Reading and writing language of a computer
- Break problems down and make solutions explicit
- Results are immediate

Source: [http://www.squeakland.org/about/intro](http://www.squeakland.org/about/intro)
Users can create models or simulations using technology

Allows users to experiment in a safe environment

Easy interface for people with little programming knowledge

Available for use on computers with basic software. No internet access is required.
What is Squeak Etoys?

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B is the correct response.
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Which of the following would be an example of using Squeak Etoys as a problem-based activity?

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B. Blah
C. Blah
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A is the correct response
By the end of this section you will have knowledge of:

- How PBL is student-centered rather than teacher-centered
- How content should be given in a PBL lesson
- Characteristics of PBL
- Criticism(s) of PBL
- Instructor’s role during PBL
Why should activities be based on real world experiences?

A. Information is more readily available to students.
B. Students are more apt to remember the content.
C. Students can research more information about their topic.
D. Students can relate to the content and form meaningful connections.

D is the correct response
PBL is beneficial to students because PBL...

A. Increases student levels of written and verbal skills and problem solving.
B. Increases students' chance to create hands-on projects.
C. Gives students a chance to work together in teams while being social during class.
D. Gives students a chance to practice skills learned during class.

A is the correct response
PBL is different than regular lecture style teaching because...

A. Students practice a concept before being taught.
B. Students work together in teams to formulate a response to a question.
C. Teachers facilitate learning.
D. Teams create a project that is based on a teacher’s specific requirements.

C is the correct response
An instructor's role is to...

A. Form teams and expect students to arrive at the correct answer.
B. Form teams, ask questions to stimulate knowledge, and encourage students to reflect.
C. Guide students towards a correct answer.
D. Lecture students before giving an exercise for students to complete.

B is the correct response.
Problem Based Learning Explained

Source: Buck Institute for Education
PBL: Problem Based Learning

Student Centered:

- Activities should be relevant
- Increases student levels of written and verbal skills and problem solving
- Students have a say in their learning
- Incorporates active, interactive and collaborative work
Example:
In this problem based learning project, students will create a calendar to be sold to raise money for the 8th grade dance. They will have to decide on the cost of producing the calendar and how much they should sell it for to create a profit. The profit will be used for the end of the year 8th grade dance.

Source: http://coollessons.wikispaces.com/
PBL: Problem Based Learning

How content should be given

- Real World Problems
- Students learn as they work to solve the problem
- No traditional lectures, teacher facilitates learning
PBL: Problem Based Learning

Characteristics:

- The starting point for learning is a problem
- Subject matter is organized around problems rather than specific subjects
- Students assume a major responsibility for their own instruction and learning
- Learning occurs in small teams instead of whole class lectures
PBL: Problem Based Learning

Instructors Job

- Ask meta-cognitive questions for guidance and support of learning
- Forming teams
- Focusing on the process and assessment of process and product
- Encourage students to reflect
PBL: Problem Based Learning

Criticism(s):

- Students can’t differentiate between what is important and what is not important
- Prior knowledge can either hinder or support new information
- Teachers need to know their students and that they can handle challenges
- No guidance in complex tasks that would otherwise be beyond their current abilities
- No scaffolding tools, strategies, or guides that support students in gaining higher levels of understanding that would be beyond their reach without the scaffolds (Jackson, Stratford, Krajcik & Soloway, 1996; Simons & Ertmer, 2006)
PBL is student centered, with small team projects based on real world experiences.

A teacher’s role is to facilitate learning, form groups and give feedback.

PBL is based around a problem, not specific subjects.
Why should activities be based on real world experiences?

A. Information is more readily available to students.
B. Students are more apt to remember the content.
C. Students can research more information about their topic.
D. Students can relate to the content and form meaningful connections.

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PBL is beneficial to students because PBL...

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An instructor's role is to...

A. Form teams and expect students to arrive at the correct answer.
B. Form teams, ask questions to stimulate knowledge, and encourage students to reflect.
C. Guide students towards a correct answer.
D. Lecture students before giving an exercise for students to complete.

B is the correct response
By the end of this section you will know:
• The main overview of the Common Core
Consistent, clear understanding of what students are expected to learn

This is important because the standards will be...
• Clear, so that educators and parents know what they need to do to help students learn
• Consistent across all states, so that students are not taught to a lower standard just because of where they live
This is important because the standards will be...

- Realistic, for effective use in the classroom
- Informed by other top performing countries, so that all students are prepared to succeed in our global economy and society
- Evidence and research-based criteria have been set by states, through their national organizations CCSSO and the NGA Center.
Help students become prepared for success in postsecondary education and the workforce

This is important because the standards will be...

- Consistent through curriculum, instruction, and teacher preparation
- In a global economy, students must be prepared to compete with not only their American peers in the next state, but with students from around the world.
- These standards will help prepare students with the knowledge and skills they need to succeed in college and careers.
By the end of this section you will know:

- The connection between the Common Core, Squeak Etoys and Problem-Based Learning
Connection

Common Core requires teacher to move from lecture style instruction to inquiry

PBL Characteristics:

- Questioning students
- Challenging students
Common Core requires teachers to teach math as a problem-solving endeavor, rather than routine exercises and practice.

PBL Characteristics:

Problem solving
Connection

In the Common Core teachers and students are expected to spend less time on memorization and procedures and more time understanding and analyzing.

PBL Characteristics:

Students work towards understanding and analyzing a single problem and analyzing different solutions.
In the Common Core assessments should provide evidence of understanding mathematical concepts and procedures, mathematical processes and practices, and students’ disposition to mathematics.

PBL Characteristics:

- Authentic, meaningful problems
- Projects that involves students in design, problem-solving, decision making, or investigative activities
Four components for the teaching and learning process:

- Integrating Squeak with PBL
- Guided Problem-based Learning Method
- Developing Critical Thinking & Problem Solving Skills
- Assessing 21st Century Knowledge & Skills
- Learning CC Content Through Modeling & Simulation
- Thinking like Scientists or Mathematicians
- Learning by Collaborating & Working as a Team
- Building Collaborative Learning Environment
- Integrating Squeak with PBL

**INCOME**

Integrating Computing and Mathematics Education

**NAVIGATION**

- Introduction
- Squeak Etoys
- PBL
- Common Core
- Connection

**TIPS**

- Practice
- Examples
- Case Study

**RESOURCES**

- Practice
- Examples
- Case Study
Example Project: A Gardner’s Dilemma
Project Description:
http://wveis.k12.wv.us/teach21/public/project/Guide.cfm?upid=3391&tsele1=2&tsele2=103
A Gardner’s Dilemma - Link

Common Core Standard:
• Math-Measurement and Data-Geometric measurement: *understand the concept of area and relate area to multiplication and to addition.*
• Math-Measurement and Data-Geometric measurement: *recognize perimeter as an attribute of plane figures and distinguish between linear and area measurements.*

PBL:
• Location of vegetables using ordered pairs
• Identify location of garden plot in their garden design
• Identify area and perimeter of garden plot
• Describe how area and perimeter were determined.