# FACILITATING PROBLEM-BASED LEARNING(PBL) IN THE CLASSROOM

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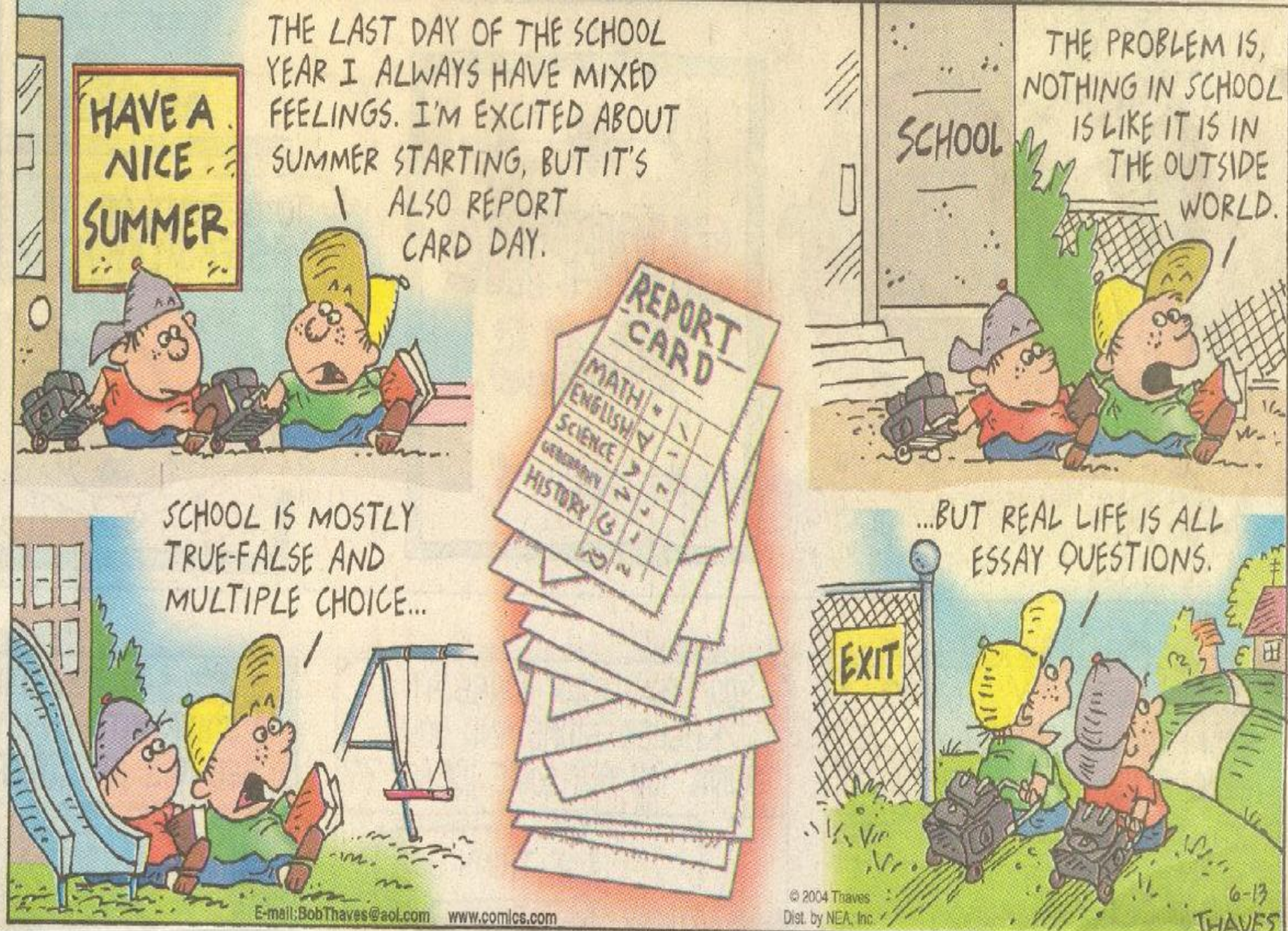
Reflect on this quote:

"Our education system is a second-rate, factory-style organization, pumping out obsolete information in obsolete ways.

[Schools] are simply not connected to the future of the kids they're responsible for."

- Alvin Toffler


HAVE A NICE SUMMER
THE LAST DAY OF THE SCHOOL YEAR I ALWAYS HAVE MIXED FEELINGS. I'M EXCITED ABOUT SUMMER STARTING, BUT IT'S ALSO REPORT CARD DAY.
REPORT CARD
MATH
ENGLISH
SCIENCE
HISTORY
SCHOOL
THE PROBLEM IS, NOTHING IN SCHOOL IS LIKE IT IS IN THE OUTSIDE WORLD.
SCHOOL IS MOSTLY TRUE-FALSE AND MULTIPLE CHOICE...
...BUT REAL LIFE IS ALL ESSAY QUESTIONS.
EXIT
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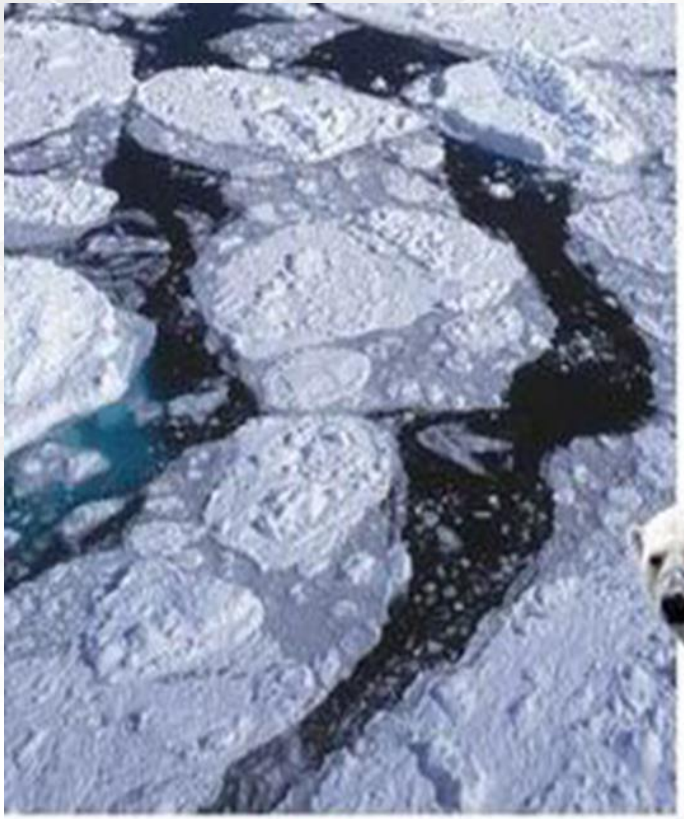

# What is Problem-based Learning?

- Problem-based learning models are teaching models designed to develop problem-solving skills and self-directed learning.
- A specific problem is the focal point for problem-based lessons, during which students design and implement investigations and solutions (Krajcik, Bluemenfeld, Marx, & Soloway, 1994).

# What is Problem-based Learning?

- Problem-based learning (PBL) is a powerful vehicle for authentic, inquiry-based learning, in which a real world problem becomes a context for students to investigate, in depth, what they need to know and want to know (Lambros, 2004).

# What is Problem-based Learning?

- Lambros (2004) defined PBL as a teaching method based on principle of using problems as the starting point for the acquisition of new knowledge.
- Situations that are in the students' real world or that they can recognize as part of their relevant future are presented as problems and stimulate the need to seek out new information and synthesise it in the context of problem scenario.
- To underscore the real-world nature of the problem, students are given a specific role in the problem scenario that enhances their ownership with working toward its resolution.

# Benefits from PBL

- Critical thinking, analysis and synthesis to identify and solve complex problems
- Information mining to find,  evaluate and use suitable learning resources
- Cooperatively work in a team
- Effectively communicate in verbal and written form
- Self-confidence and self-worth
- Continual and independent learning

# Benefits from PBL

- Acquisition of integrated knowledge
- Development of reasoning skills
- Development of problem-solving skills
- Development of self-directed learning skills
- Ability to work efficiently, effectively and ethically in groups, and
- Development of communication skills (Wee Heng Neo, 2004).

# PBL Models and Key Components in PBL Process

Problem-based learning models share three characteristics:

(1)They begin with a problem or question that serves as the focal point for the students' investigations (Duffy & Cunningham, 1996; Grabinger, 1996);

(2)Students assume primary responsibility for investigating the problem (Slavin, Madden, Dlan, & Wasik, 1994); and

(3) The teacher facilitates the process by guiding the student's efforts and providing support when necessary (Stephen & Gallagher, 1993).

# Key components in PBL approaches

1. Problem presentation
2. Problem triggers inquiry
3. PBL stages

a. initial analyses

b. generation of learning issues

c. iterations of independent and collaborative problem solving

d. integration of new knowledge

4. Solution presentation and evaluation(Oon-Seng Tan, 2003)

# PBL Cycle (Lambros,2004)

- A student reads the problem aloud in a group.
- Students identify the facts, *"What they know".*
- Students identify learning issues, "*What they don't know".*
- Students identify what could be going on, their ideas to move them forward in exploration.
- Students make decisions about how to proceed.

# PBL Cycle (Lambros,2004)

- Students acquire new information through research or additional resources.
- Students test their ideas against new knowledge, re-rank ideas as needed.
- Students continue to acquire new information and integrate it with that they know.
- Students arrive at most viable and defendable hypothesis solution.

# Example of PBL Scenario (Lambros, 2004)

Roll Out the Barrel!

Scenario 1

You are a chemist working at the Ministry of Environment and Water. One of your laboratory assistants informed you about a call:

A young couple has purchased a farm approximately 30 miles outside of town. They wish to convert the barn into a house, which they plan to live in. Upon examination of the area, they discovered several barrels of some liquid substance. Concerned about dumping the contents of the barrels, they have contacted your office for advice and to determine if it is safe to dump the barrels' contents.

You decide to visit the site and collect samples from the barrels to test in the laboratory.

Some questions:

1. What are some possibilities that can help identify the liquid samples collected?
2. How will you determine if the liquid is harmful?
3. What additional information would like to have which are not stated in the scenario?

# Example of PBL Scenario (Lambros, 2004)

Roll Out the Barrel!

Scenario 2

After performing the tests, you have narrowed the possibilities down to the following liquids. Using the resources in your lab, you have prepared these notes:

| Substance | Density (g/cc) | Boiling Point °C | Viscosity | pH |
|---|---|---|---|---|
| Water | 1.0000 | 100.0 | 0.890 | Neutral |
| Methanol | 0.7914 | 64.7 | 0.544 | Basic |
| Ethanol | 0.7893 | 78.2 | 1.074 | Basic |
| Acetic acid | 1.0500 | 117.9 | 1.056 | Acidic |
| Ethylene glycol | 1.1080 | 197.4 | 16.100 | Basic |
| Acetone | 0.7899 | 56.1 | 0.306 | Basic |
| Benzene | 0.8765 | 80.1 | 0.604 | Basic |

Using this data, can you identify the liquid substance?

What information will you share with the couple?

# PBL Thinking Template (Lambros,2004)

| Facts List | Need to Know | Learning Issues |
|---|---|---|
| | | |

| Possible Solutions | New Learning Issues |
|---|---|
| | |

| Defendable Solution(s) |
|---|
| |

# PBL Thinking Template (Lambros,2004)

(1) Facts

- Series list of facts given in the problem
- Helps them to begin identify what they know

(2) Need to Know

- List all information they would like to have (which are not found in the scenario) to better understand the problem and their role on resolving the problem

(3) Learning Issues

- List of the things they need to look up, research, or explore in order to move forward with problem resolution (represents the new content students will learn stated as lesson objectives that will be translated as lesson progresses )

# PBL Thinking Template (Lambros,2004)

(4) Plan of Action

- List of next steps to be taken in order to obtain new information

(5) Possible Solution

- List of ideas (hypothesis) about how to resolve the problem and should require the development of New Learning Issues list

(6) New Learning Issues

- New list is used to gather additional information that will allow the students to rule in or rule out the possible solution they created

(7) Defendable Solution(s)

# PBL Scenario Construction (Lambros, 2004)

- What is the role of the problem?
  *Includes your objectives, what you want students to learn.*
- How do you engage students?
  *What will make them want to know more, the appeal to go forward.*
- How do you organize the problem?
  *Includes length, richness, work inside & outside of the classroom.*

# What is the role of the problem scenario?

- *Create* the need to know
- *Interest and engage* the student
- *Motivate* discovery of the content intended
- *Appeal* to human desire for resolution and harmony
- *Provide the context* of the learning

# How do you engage the students?

- Consider characteristics of the learner, what is their next place in the real world?
- Let them interpret the problem
- Make the student responsible for the learning that occurs
- Let them be creative
- Give them a “real” role in the problem

# How do you organize the problem?

- It should be messy like real life.
- It changes with new information.
- It creates the desire to know more before giving away too much.
- It should be authentic.
- It requires sharing of information.
- It tells a story.

# Steps in Developing PBL Problem (Scenario) for Classroom Use (Lambros, 2004)

***Step One***

- Select the **objectives** that you want your problem to accomplish.
- These **objectives** will eventually translate into **learning issues** and will represent the **new content** that students will acquire as they work through the problem. Ask yourself, ***"What do I want my students to know when the problem is completed that they do not know now"?***
- Identify and make a list of the objectives that you would like students to understand before you write the problem scenario.
- Consider also where this information shows up in the **real world.**

# Steps in Developing PBL Problem (Scenario) for Classroom Use (Lambros, 2004)

***Step Two***

- Create a **story line** that will appeal to your learners and quickly interest them in pursuing the learning objectives you have outlined.
- Identify the **students' role** early in the problem; this gives them the reason to want to know the needed information. Usually, **each problem begins** with the words **"You are . . ."**
- Remember to put the students in roles that are relevant to their world, the interest they have, and their capacity for understanding the role.
- The role of students  given in the PBL problem will often drive the story line. Emphasize what appeals to students, not what you think would be "good" for them to do.

# Steps in Developing PBL Problem (Scenario) for Classroom Use (Lambros, 2004)

***Step Three***

- Be careful not to overwhelm the students with too much information when you create a story line or a scenario.
- In-experienced scenario writers tend to fear that students will not pursue the intended content areas unless they are directed to do so by the problem scenario.
- The common mistake is to overload the problem with so too many facts and too much detail.
- Part of problem development and selection will be dictated by what you want to accomplish with the problem and how much time you want to spend on one problem.

# Steps in Developing PBL Problem (Scenario) for Classroom Use (Lambros, 2004)

***Step Three***

- Rich story lines usually have students make more decisions about how and where to find new information.
- These types of problems often extend over several class periods and need to be rich in order to hold the students' interest for several days.
- Briefer scenarios usually require less research and are accomplished in one or two class periods.

# Steps in Developing PBL Problem (Scenario) for Classroom Use (Lambros, 2004)

***Step Four***

- Read aloud or preview your story line to at least one other person before introducing it to your class.
- This will help you predict how someone other than yourself will interpret the problem.
- Ask your previewers to tell you what they think students will say they need to know and what they think the intended objectives are.
- This quick preview often reveals if the problem needs to be revised or tweaked before introducing it to students.

# Steps in Developing PBL Problem (Scenario) for Classroom Use (Lambros, 2004)

***Step Four***

- Ask your previewers to role-play the student the problem is intended to reach.
- Have them read the problem aloud, tell you what they know (facts) and what they need to know (learning issues).
- You can then determine if the problem goes in the direction you want and if you have accurately anticipated the learning areas and objectives that students will choose.

# Considerations in Using PBL

- Assess students' readiness in terms of foundation knowledge, maturity, needs and motivations
- To prepare students in terms of mindset change and skills for group work, reading, time management and information mining
- To plan for scaffolding processes in the PBL cycle
- To provide appropriate levels of resource guidance
- To design good and motivating problems
- To ensure that there is a closure process

# Getting Started

- Select the objectives/topic area
- Write something down quickly—you can change this anytime
- Remember to give the student a role, “You are the…”
- Do not overload the first scenario, keep it simple and straightforward

## Brainstorm Problem Sources

- Current Events
- Personal Experiences
- Controversies
- Historical Events
- The upcoming real world experiences for your students

# PBL Resources

**BE PRACTICAL!**

- What do you use for real world problems?

Examples: telephone, phone book, other people, newspaper

- What's in your classroom now?

  Examples: books, maps, charts

- What's in your LRC?

  Examples: books, reference texts, videos, CDs

**BE CREATIVE!!**

- Make up reference sheets with data about the anticipated learning issues
- Make a problem around a resource you already have such as a magazine or newspaper article
- Have students brainstorm resource possibilities, they know more than we know they know.

# How is PBL implemented?

**Before the PBL Class**

- Determine the content and process outcomes to be achieved
- Be familiar with the problem and the ideas, learning issues and resources that students may generate
- Ensure that there are sufficient copies of the problem for all the students
- Ensure that the physical setting of the room is conducive to learning

# How is PBL implemented?

**During the PBL Class**

- Surrender the seat of authority to the students
- Promote a “safe” non-threatening learning climate that supports uncertainty and ambiguity
- Guide students through the small group PBL process
- Facilitate the learning process by activating learning and probing students with non-directive questions
- Probe for deeper reasoning and understanding
- Moderate student participation in group discussion
- Intervene to address dysfunctional group behavior
- Make educational diagnoses and intervene to ensure that the PBL outcomes are attained
- Adopt the “model-support-observe-fade” approach

# How is PBL implemented?

**After the PBL Class**

- Provide feedback during the assessment of the students and the group in terms of attaining the outcomes of the PBL curriculum
- Guide students to complete the assessment tools to assess the attainment of PBL outcomes (i.e. rubrics, portfolio, checklist, rating scale, learning log, journal, self- and peer assessment
- Evaluate the effectiveness of the class

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# THANK YOU VERY MUCH FOR YOUR TIME!