

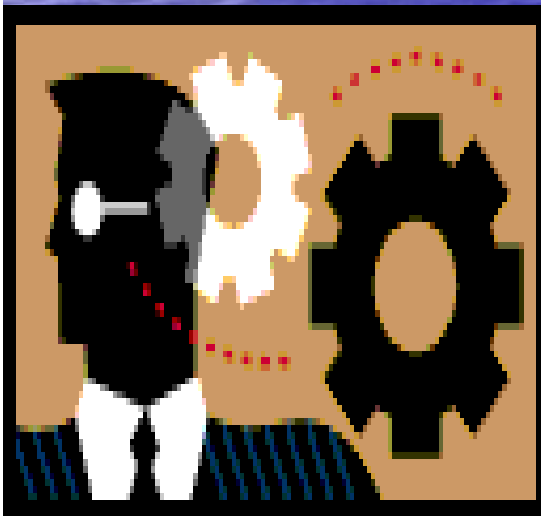
# Problem-Based Learning

## 問題導向學習模式

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How can I get my students to think ?

# Goal

➤ To introduce

**Problem Based Learning**

focusing on

**improving instruction** to better  
meet the needs of our students.

# Outline

- Introduction
- Define Problem-Based Learning (PBL)
- Why PBL?
- PBL Process
- The Role of Stories in PBL
- Does PBL Work?
- Reasons for not Implementing PBL
- Final thought and Summary

# Introduction

**Education is the key to success**

The role of education, in general,  
is the training in problem solving

**Courses in universities seldom  
cover creativity, innovation or  
problem solving**

# Introduction

Tell me and I will forget

Show me and I will remember

Involve me and I will understand

Step back and I will act

出自荀子《儒效篇》：「不聞不若聞之，聞之不若見之，見之不若知之，知之不若行之；學至于行之而止矣。」

白話翻譯：未聞不如耳聞，耳聞不如目睹，目睹不如心領神悟，心領神悟不如身體力行。能學至身體力行便足夠了。

意旨：一個人的學習態度，應以身體力行爲先。

Good teaching should focus on what the students are doing



# Introduction

**PBL helps our students to keep pace with the continually expanding knowledge base in the world.**

- students must become life-long, self-motivated learners;
- learning takes place in small group tutorials and is problem-based and self-directed;
- progress is monitored by continuous personal and group evaluation

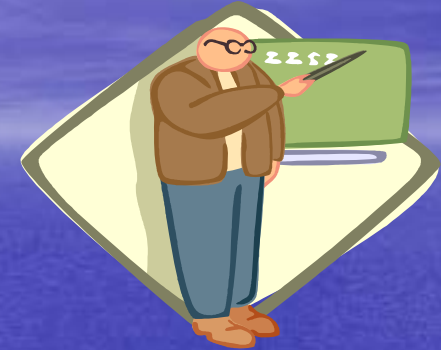
# PBL Defined

**PBL was first developed as an alternative to traditional medical education at McMaster University, Canada in 1969**

- PBL has two key components:
  - Starting point is a ***problem***
  - ***Student-centered*** approach
- The teacher has the role of **facilitator** and **coach** rather than the "sage on the stage"

# Traditional program

**Teacher-centered**



**Teacher or textbook determines  
what the students should know**



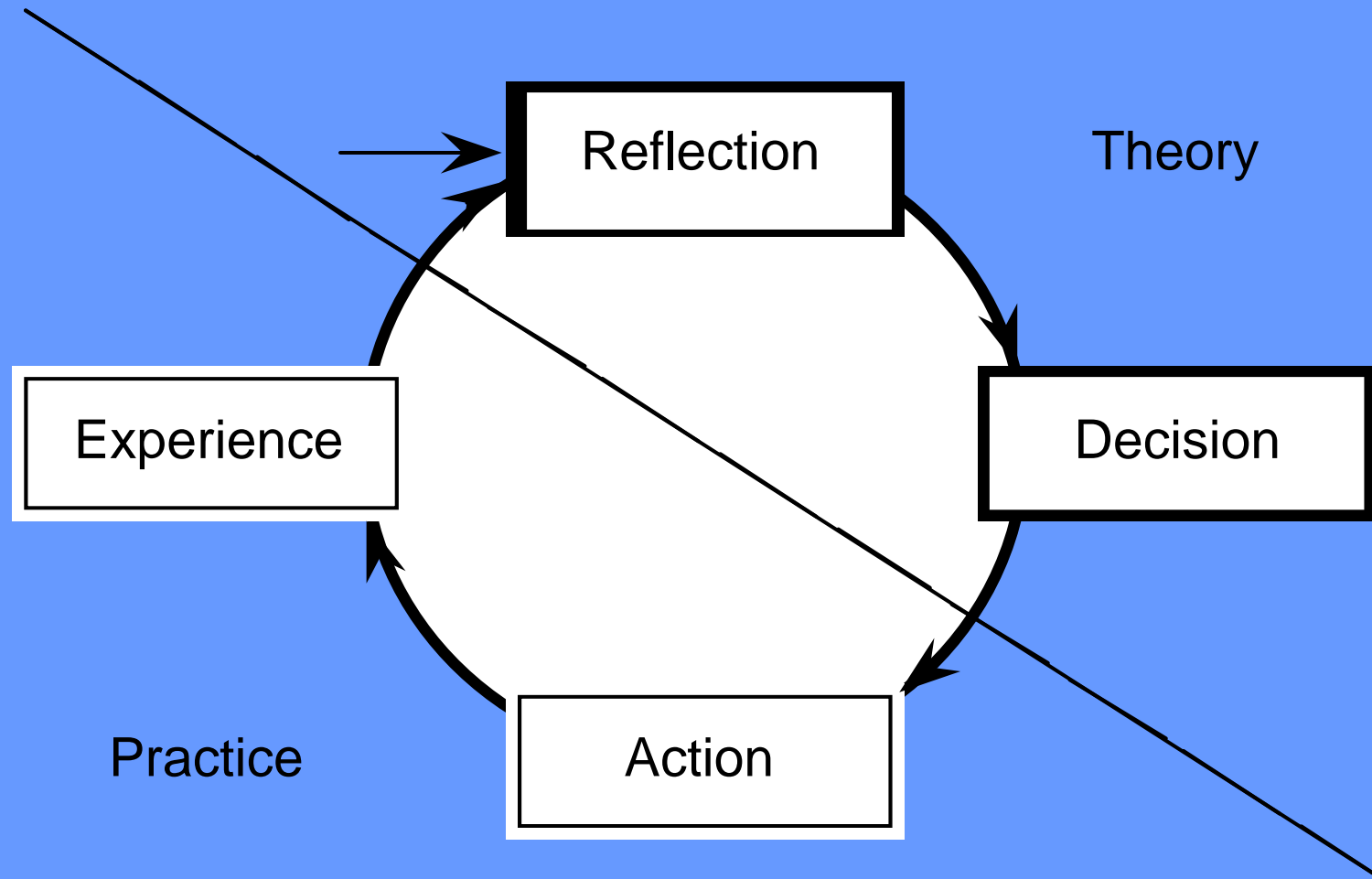
# PBL Defined

## Other terms similar to PBL

- Case method
- Project-oriented
- Cooperative learning
- Active learning
- Research project
- Objective based active learning

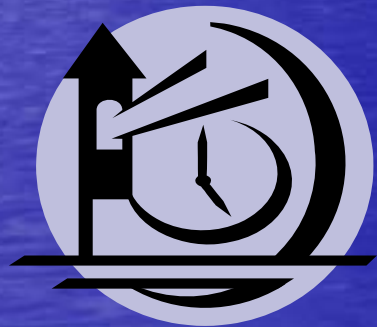


# Basic Principles of Outcomes Based Action Learning



# PBL Defined

- “Learning which results from the process of working towards the understanding or resolution of a problem”



*Manchester School of Engineering*

# PBL Defined

- There is debatable in what is authentic PBL

## Principles that collectively make up PBL

- student centeredness
- learning through self-directed discovery
- problems as triggers for learning
- collaborative work
- critical reflection

# Why PBL?

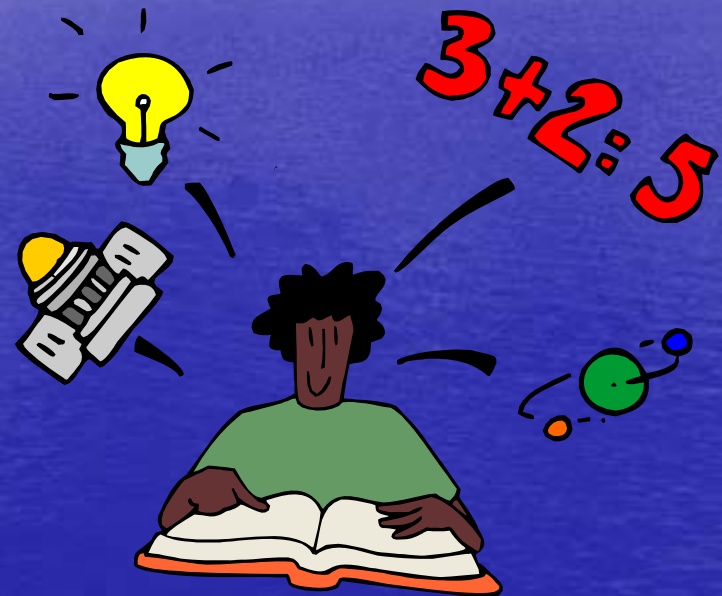
- **Changes in the student population (lack of adequate preparation, manifestation of boredom).**
- **All of us had witnessed the change in our students, and each reacted in different ways (outrage, withdrawal, career changes, etc.).**
- **We could not change the attitude and competence of arriving students, but we could work on transforming them for the period of time they were with us.**

# Why PBL?

- If we do nothing, our retirement years will be miserable and perhaps even unlivable.
- Imagine: what life would be like if we failed to educate our students, but gave them degrees anyhow. Students passing bridge design course when he should not. Student sleeping through surgery but managed to pass the exam.
- Problems are becoming more complex (global warming, energy shortages, and political conflicts) requiring deeper thinking and analysis to uncover solutions.

# Why PBL?

"I am always  
ready to learn  
although I do  
not always like  
being taught"



*Winston Churchill*

# Why PBL?

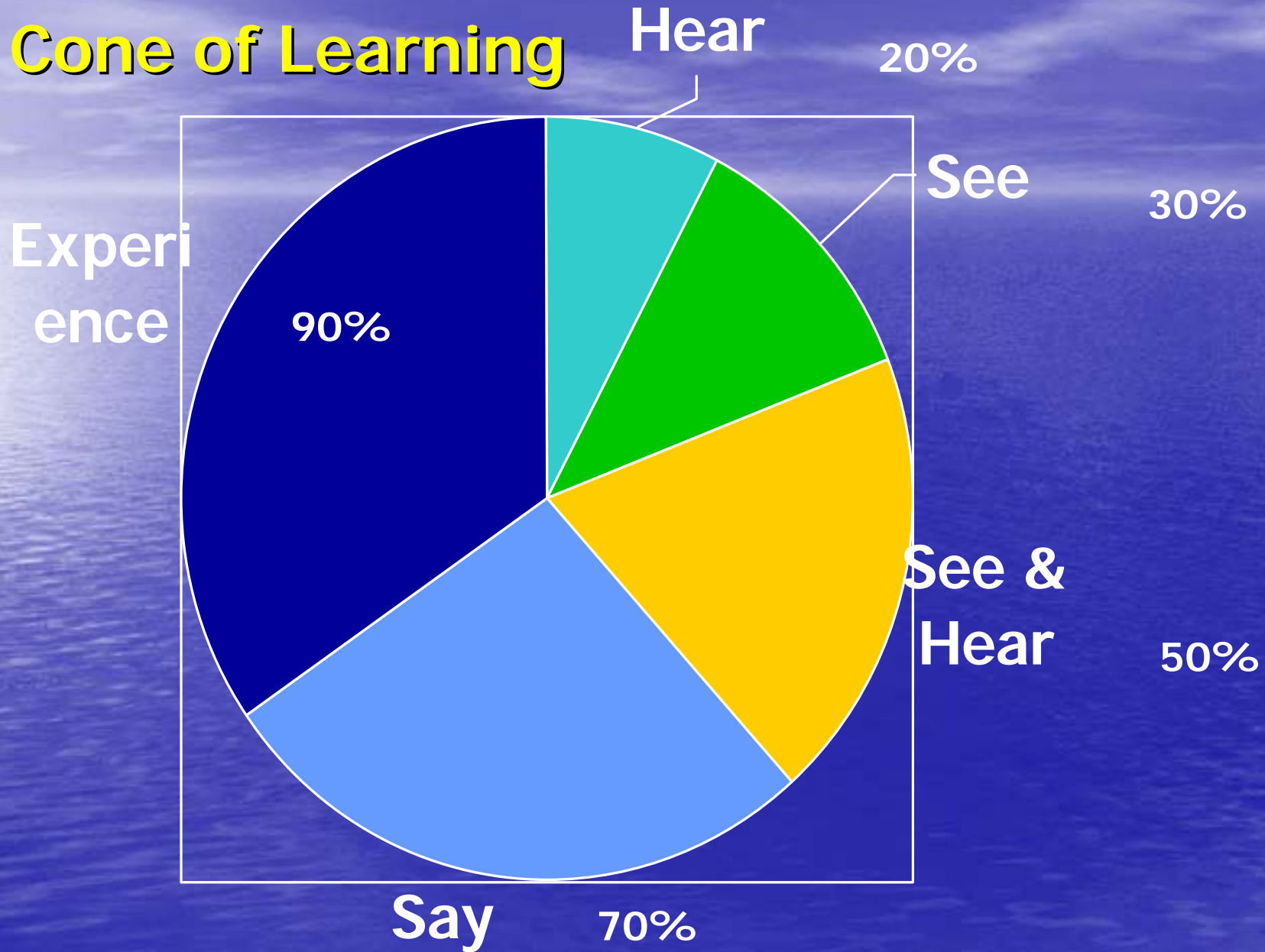
- PBL is the key to teaching students how to cope with the changing world
- Better training in “non-technical skills”
  - good communication and the ability to work in teams
- To train students with competence to seek and utilize new knowledge independently
- To help students learn how to learn





# Why PBL? Learn and Retain

## Cone of Learning



# Why PBL?

- Traditional teaching method not adequate; students struggle to apply what is learned. Study of real life problems in PBL fosters insight into what to expect in their job
- By starting with a problem, the students can identify their learning needs and structure learning accordingly
- Skills and knowledge that PBL students acquired give them more confidence and enable them to be more successful upon graduation

# PBL Process

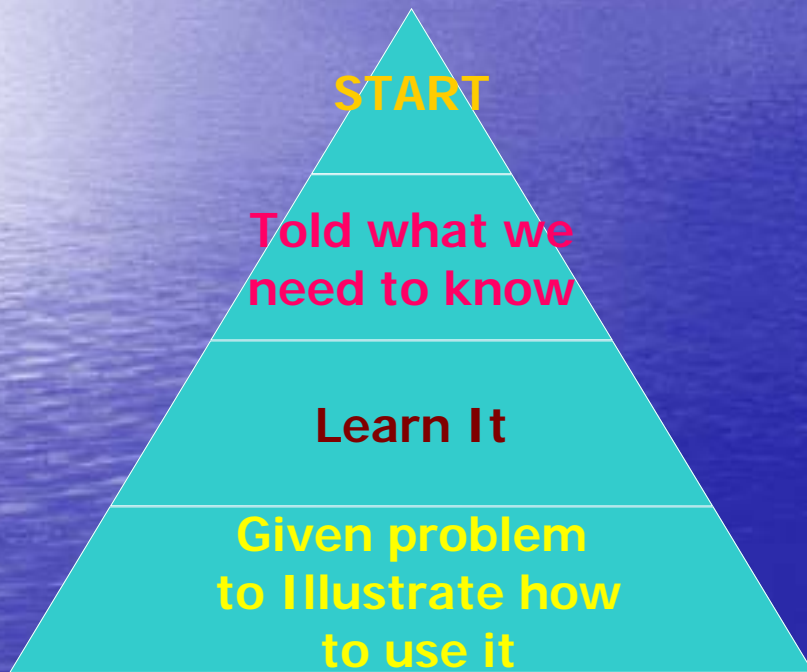
*The Process consists of six steps:*

- Exploration of the problem and generation of hypotheses
- Identification of learning issues (based on prior knowledge) and information sources
- Information gathering and independent study
- Critical discussion of the knowledge acquired (in a group setting)
- Application of the knowledge to solve the problem
- Reflection on the process and provision of feedback

# PBL Process

How is this different than a traditional program?

## TRADITIONAL

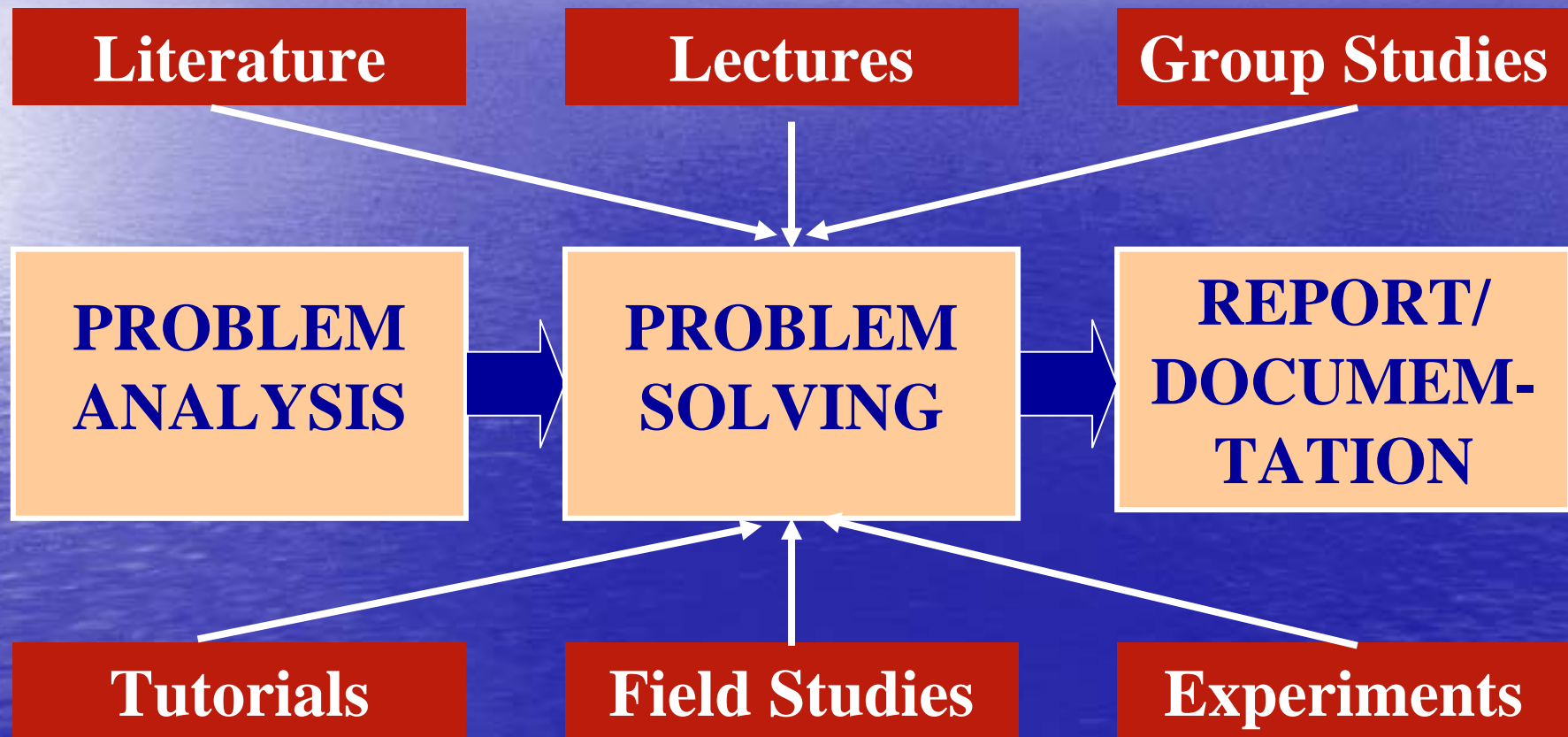


執行步驟

*Donald R. Woods*

# Problem Based Learning

Implemented at Aalborg University since 1974



# The Role of Stories in PBL

**Stories are the most natural form of teaching**

Our ancestors used stories to pass down important lessons

**Almost 2000 years ago, Jesus used stories (parables) to teach**

**Supporting problems with stories can help students gain clearer insight and experience**

**Successful preachers use stories to foster deeper understanding, and aid memory**



# The Role of Stories in PBL

In **fire commander training**, stories are used as a primary instructional method

In **engineering**, case studies (a form of story) are essential to learning complex problems

In **business management training**, real stories are used to help students developing problem solving or decision-making skills

**Stories function as a substitute for direct experience**



# Evaluating PBL

Kirkpatrick's hierarchy levels of evaluation



評估Kirkpatrick 的階層



# Does PBL Work?

## Engineering curriculum findings

- students chose to go to Aalborg because of PBL
- students are enthusiastic about group work
- half of practicing engineers felt source of their professional knowledge was from **project work**
- Students felt better prepared in **management, cooperation, problem-solving, team work, and general technical knowledge**

# Does PBL Work? Health Sciences Research



- PBL students in medical programs demonstrated **better clinical performance**
- Nursing PBL students were **better prepared in communication and self-directed activity**
- PBL students **spend more time in the library, check out more library books, use a wider variety of written resources, and place more emphasis on journals and on-line literature searches**

# Engineering Curriculum with PBL

## In Australia

- **University of Technology, Sydney**
- **Monash University**, in Civil Engineering

## In Canada

- **McMaster University**, Canada. Some courses in Chemical Engineering
- **University of British Columbia**

## In Britain

- **University of Manchester**, England in School of Engineering. Undergraduate classes in Mechanical and Aeronautical Engineering

## In Denmark

- **Aalborg University**, in Engineering and Natural Science

# Engineering Curriculum with PBL

## In Singapore

- Temasek Polytechnic,. Diploma in Computer Engineering is completely PBL
- Republic Polytechnic, Singapore. All PBL. Diplomas in 'Electronics' and 'Industrial Systems' Engineering

- **In the United States:**

- Clemson University, South Carolina
- North Carolina State University, North Carolina
- Stanford University, California
- University of Akron, Ohio
- University of Connecticut, Connecticut
- Wayne State University, Michigan

Most other university programs are based on traditional curriculum and way of teaching

[www.udel.edu/pbl](http://www.udel.edu/pbl)

# Top **10 Skills** Essential in Today's Worker

- Reading
- **Writing**
- **Computing**
- Speaking
- **Listening**
- **Solving problems**
- Managing yourself
- **Knowing how to learn**
- **Working as part of a team**
- Leading others

**\* PBL is key to learn the skills**

*William Bridges "Job Shifts in the New Economy"*

# Reasons for not Implementing PBL

- "It is not difficult to find educators who are sympathetic to the principles of PBL but what is challenging is having the will, capacity, opportunity, and knowledge of how to apply these principles to specific contexts. For those embarking on the path of implementing PBL, the way is often unmapped and the light is dim."

*Glen O'Grady, Republic Polytechnic*

# Reasons for not implementing PBL

## Students' concerns

- whether they learn all of the required contents
- problems with group process
- inconsistent faculty expectations

## Faculties' concerns

- whether they teach all of the required contents
- loss of control in what the students learn
- difficulty with evaluation

# Final Thought - Charting our Course

*"A journey  
of a thousand miles  
starts  
with a single step"*

*Confucius*



孔子說：旅千里之行始於一個單一的一步。



# Final Thought - Continuous Learning

*PBL teaches students how to learn by themselves*



給學生一條魚，  
不如教他如何釣  
魚！

Teaching Tips

[http://www.mcmaster.ca/learning/teaching\\_tips/tipshome.ht](http://www.mcmaster.ca/learning/teaching_tips/tipshome.ht)

# Summary

- Evidence from the past 20 years of experience in engineering programs suggests PBL as the answer to teaching students how to solve problems
- Despite its effectiveness, most engineering faculties still hesitate to use PBL
- For those who are willing to apply PBL, you will be critical in making your university a world class university !

◆ 參考文獻：

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- [2] Northwood, M.D., Northwood, D.O., and Northwood, M.G., 2003, Problem-based learning (PBL): from the health sciences to engineering to value-added in the workplace, *6<sup>th</sup> UCIEE Annual Conference on Engineering Education*, pp.19-32.
- [3] Savander-Ranne, C., 2003, Improving the conceptual understanding of engineering students, *6<sup>th</sup> UCIEE Annual Conference on Engineering Education*, pp. 85-90.
- [4] Wee, H.M., and Samuel Wang, 2003/2, A Creative Approach to Teaching and Learning Problem Solving in Engineering Education, *6<sup>th</sup> UICEE Annual Conference on Engineering Education*, pp.312-314, Cairns, Australia.

# Thank you

## God Bless



### Any questions?

