Problem based Learning

-- Designing problem scenarios

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Math, MSST
Background information

**Module:** Mathematics (Elective module)

**Participants:** FT CE(ECE) Year 2 students

**Age:** 18 – 22 years old

**Gender:** Female

**Number of students:** 13 (4 groups)

**Date:** 21 February, 2008 (Chinese Valentine’s Day)

(Fifteenth day of the first month in the lunar year)
Objectives

• *Critical thinking skills*
• *Communication skills*
• *Group problem-solving skills and team dynamics*:
  • Formulating the problem
  • Discovering an area relation with no. of pins on a geoboard
  • Representing the relation in formula *(Pick’s formula or its weaker version)*
• Refining and adjusting the formula
## Designing problem scenarios

<table>
<thead>
<tr>
<th>Content</th>
<th>Context</th>
<th>Ownership</th>
<th>Problem structure</th>
</tr>
</thead>
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Designing problem scenarios

• Content

Difficulty of the subject matters to be studied must not be at a high level which could discourage students.

Pre-requisites: Knowledge of basic area formulas
Designing problem scenarios

- Content
- Context
- Ownership
- Problem structure
Designing problem scenarios

• Context

Include situations which attract students’ attention
### Designing problem scenarios

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Designing problem scenarios

• Ownership of the problem

By making suitable personifications, students must be given the opportunity to treat the problem as if it were their problem and to be willing to solve it.
## Designing problem scenarios

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Designing problem scenarios

• Problem structure
  - ill-structured
Trigger 1:
Today is Valentine’s day, Wendy wants to make a heart-shape card to his boyfriend. She went to a shop and found a special type of paper. Then she asked the shopkeeper how much it is. Shopkeeper said, “Its cost is $1/cm^2. In fact, we can help you to cut the paper into any shape and the price will be calculated according to the area of the shape. However, you need to tell me how to find the area of the shape.” Wendy said: “Good! Thank you very much!”

Activity 1: Please help Wendy to list some possible methods to find area of a heart shape.
Designing problem scenarios

• Problem structure
  - ill-structured

  How large?

Approximate value?

Make a heart-shaped card

How to find its area?
Designing problem scenarios

• Problem structure
  - ill-structured
  - Open-ended
Designing problem scenarios

• Problem structure
  - Open-ended

How to find its area?
Count square Method
Polygon Approx. Method
Dissection Method
Designing problem scenarios

• Problem structure
  - ill-structured
  - Open-ended
  - Problem must raise the concepts and principles relevant to the subject matter area
**Trigger 2:**

The shopkeeper wants to know the way which Wendy used to find the area. However, he has serious short-sighted and recently, he has broken his glasses. He gives a geoboard to Wendy and asks her to use it to find the area. Can you help Wendy to solve the problem?
Designing problem scenarios

• Problem structure
  - ill-structured
  - Open-ended
  - Problem must raise the concepts and principles relevant to the subject matter area
Designing problem scenarios

• Problem structure
  - ill-structured
  - Open-ended
  - Problem must raise the concepts and principles relevant to the subject matter area
  - It encourages students to learn new concepts when solving problems
Results

Group 1

\[ \text{Area} = \frac{\text{total points}}{2} - 1 \]
Results

Group 2

Area = $\left(\sqrt{\text{total points}} - 1\right)^2$
Results

Group 2 & 3

\[
\text{Area} = \frac{\text{total points} + (\text{no. of points inside} - 2)}{2}
\]

Pick’s formula!
Results

Group 4

Area \times 2 + 2 = \text{total points}
Designing problem scenarios

• Problem structure
  - ill-structured
  - Open-ended
  - Problem must raise the concepts and principles relevant to the subject matter area
  - It encourages students to learn new concepts when solving problems
After all, …

A comfortable, relaxing and safe learning environment must be established in order to develop students’ skills on thinking and problem-solving by themselves.

The experiment was carried out in week 6
Limitation

• Groups or individuals may finish their works earlier or later.

Possible Solution

• Prepare one to two more applications for them to tackle.
Thank You!