

Problem based Learning

-- Designing problem scenarios

Wing Sum Chan
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

Content

Context

Ownership

Problem structure



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

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



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

Designing problem scenarios

Content

Context

Ownership

Problem structure



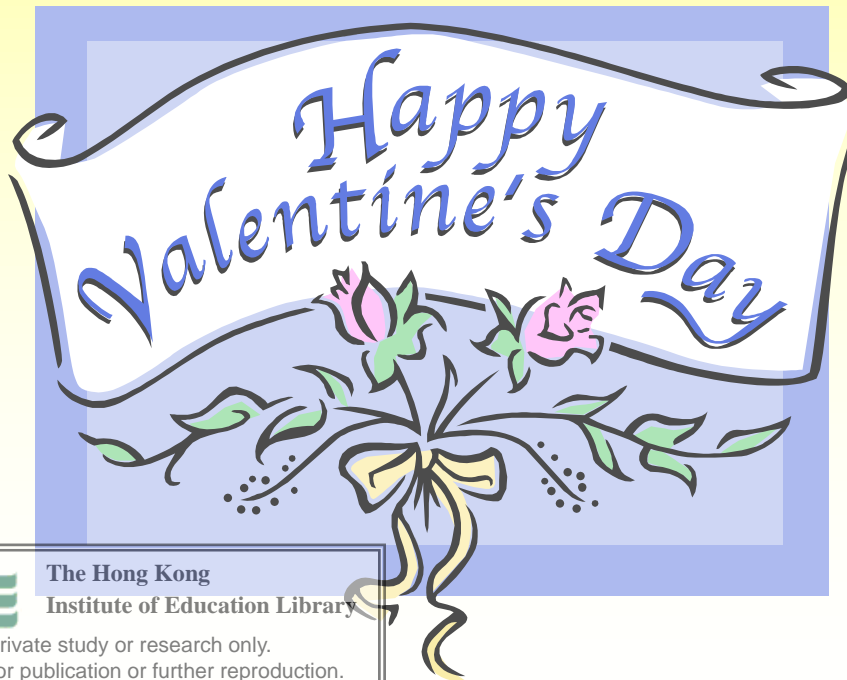
The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

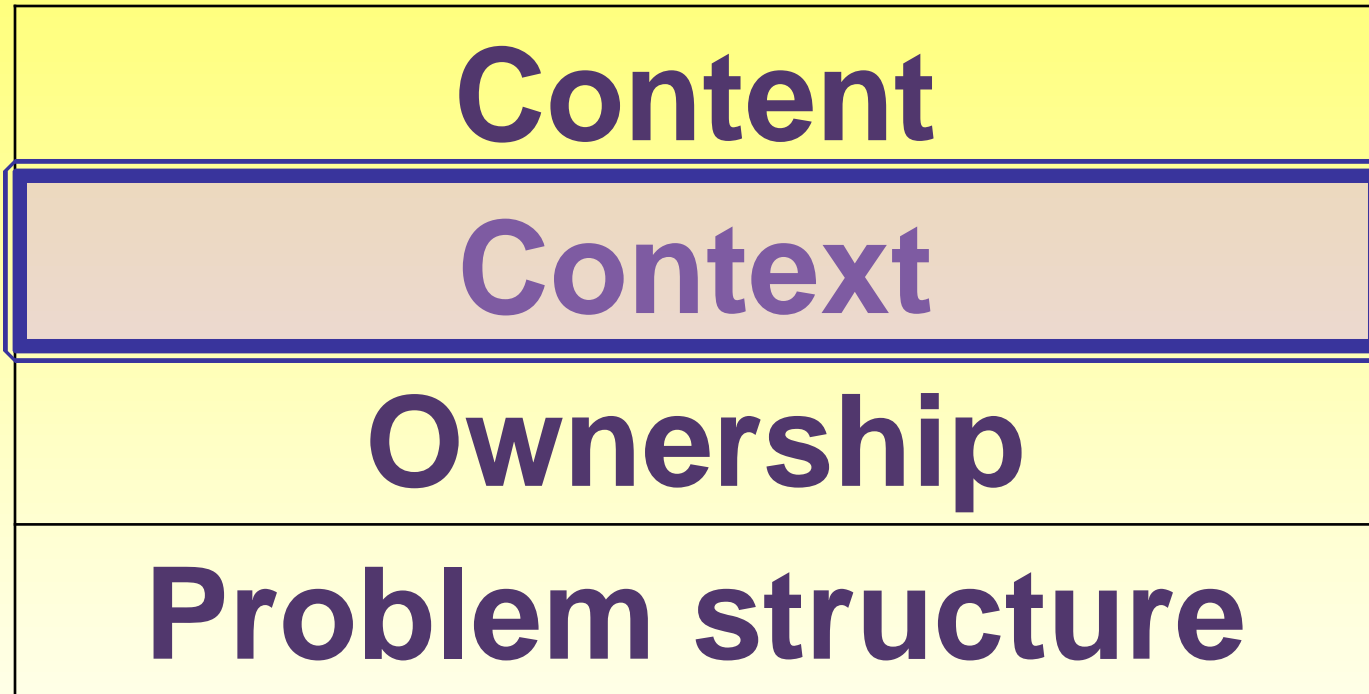
Designing problem scenarios

- **Context**

Include situations which attract students' attention



Designing problem scenarios



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.

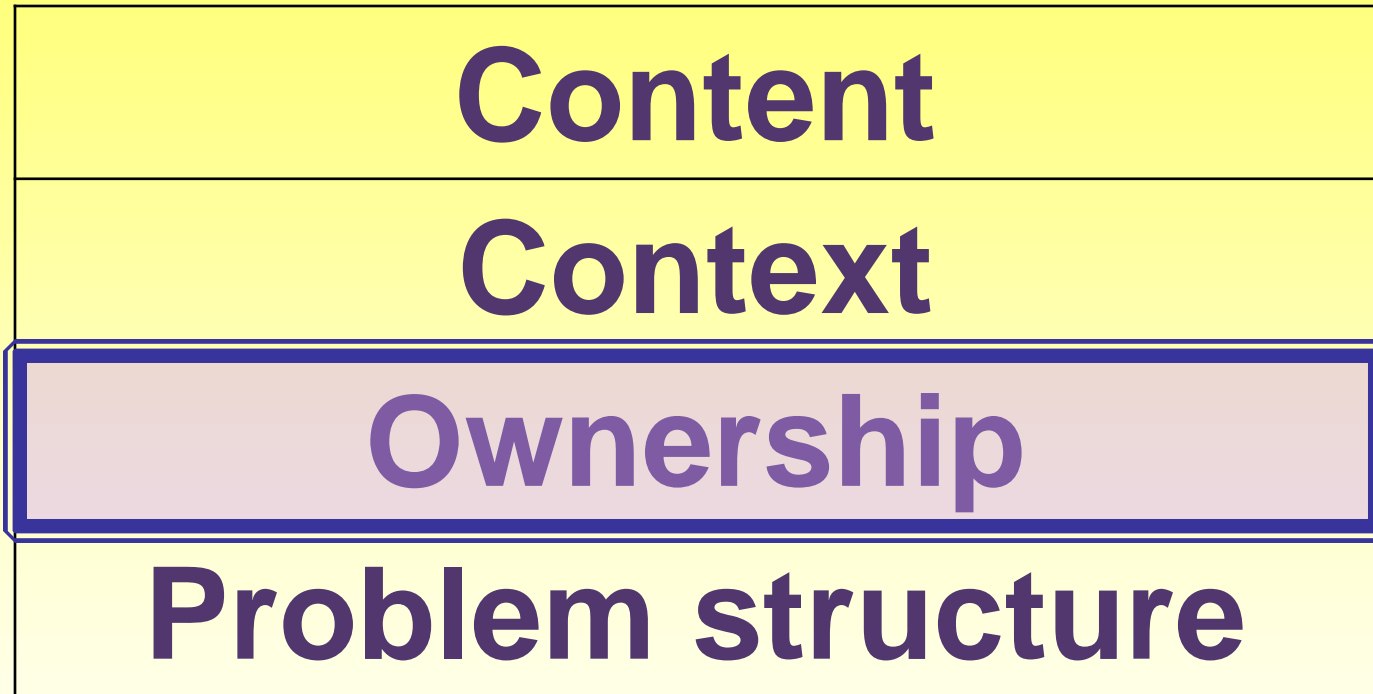
Make a greeting card to boyfriend



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

Designing problem scenarios



Designing problem scenarios

- **Problem structure**
 - ill-structured



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.



Trigger 1:

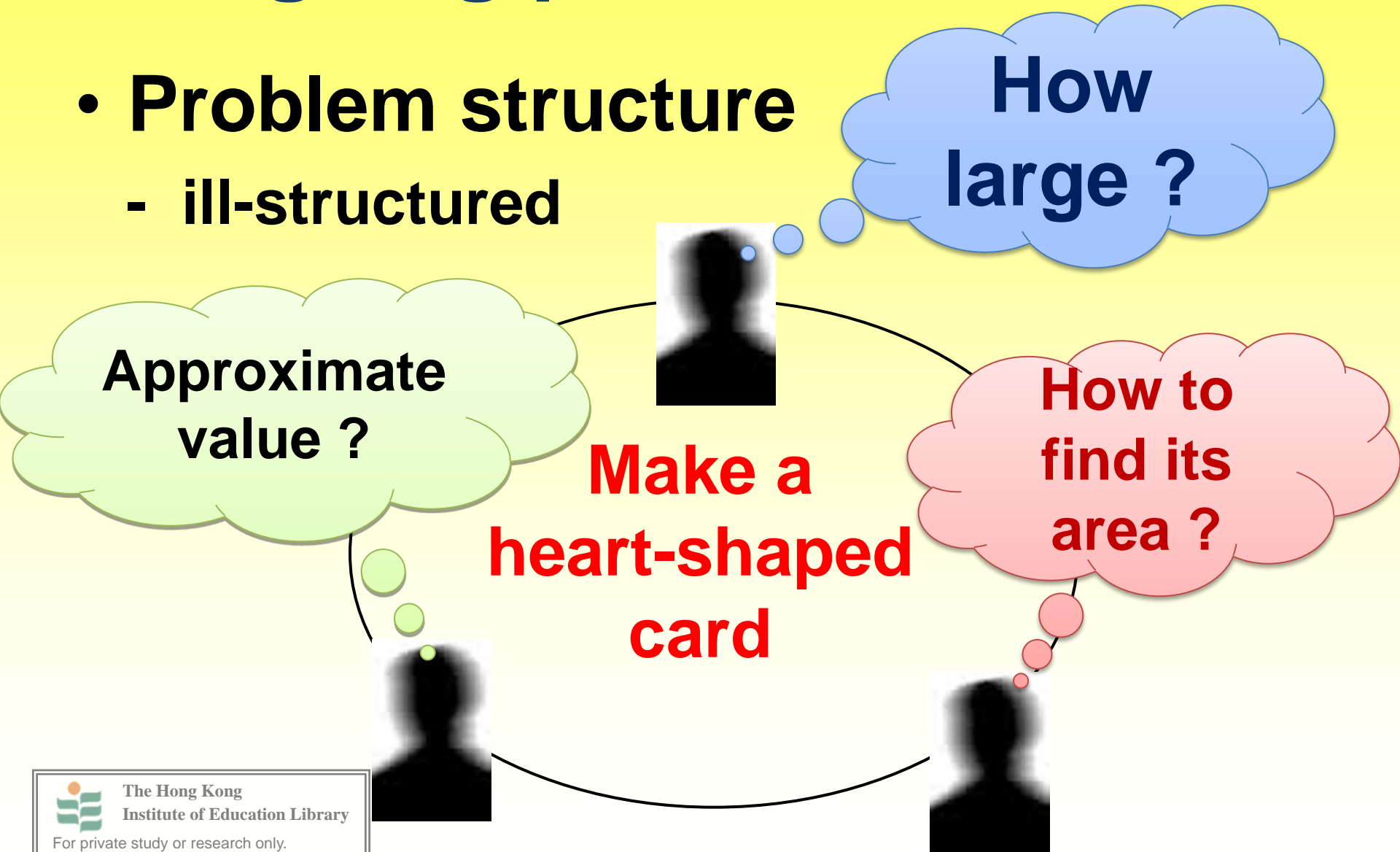
Today is Valentine's day, Wendy wants to **make a heart-shape card to his boyfriend**. She went to a shop and found a special type of paper. Then she asked the shopkeeper how much it is. Shopkeeper said, "**Its cost is \$1/cm²**. In fact, we can help you to cut the paper into any shape and the price 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**



Designing problem scenarios

- **Problem structure**
 - ill-structured
 - Open-ended



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

Designing problem scenarios

- **Problem structure**
 - **Open-ended**



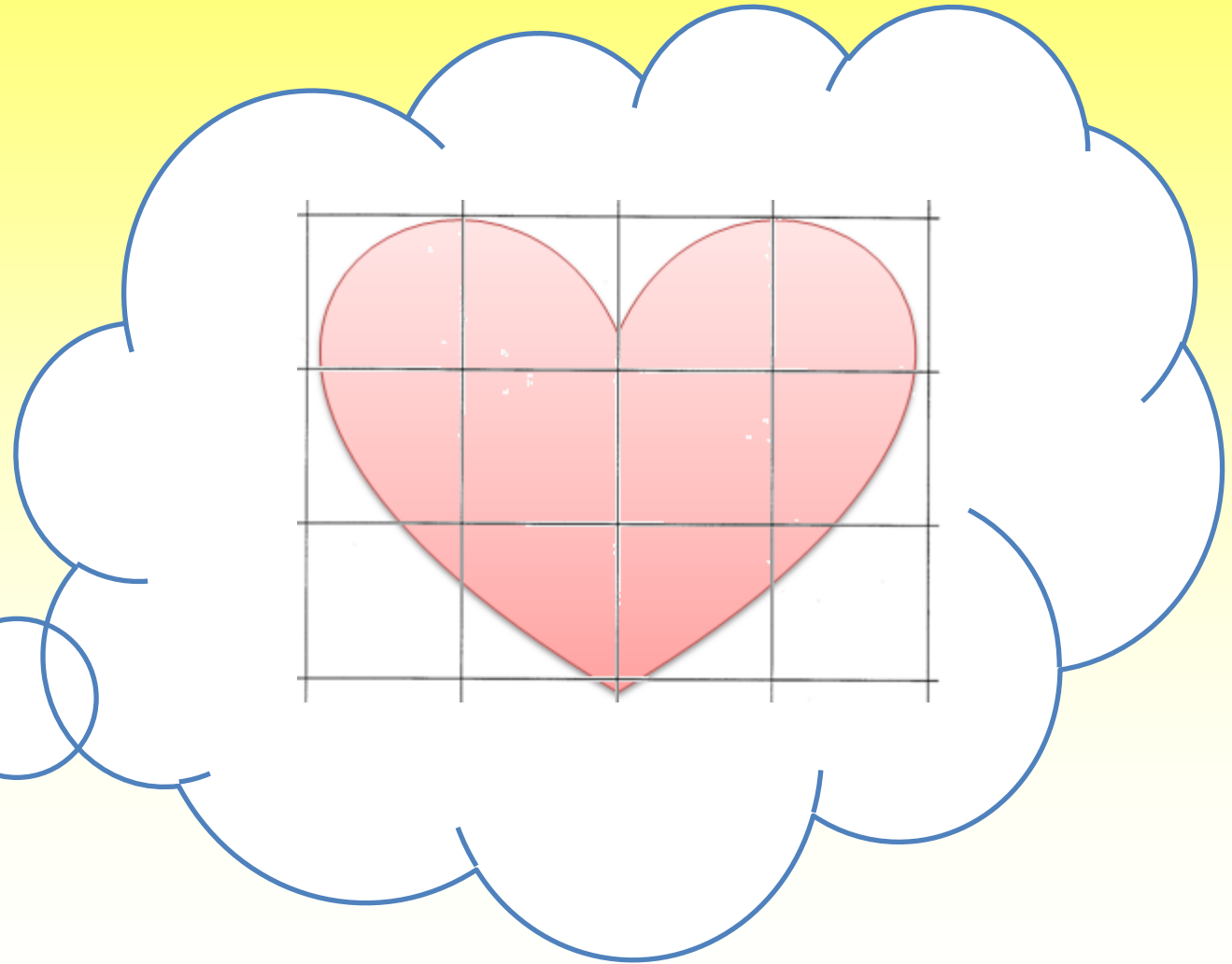
**How to find
its area ?**



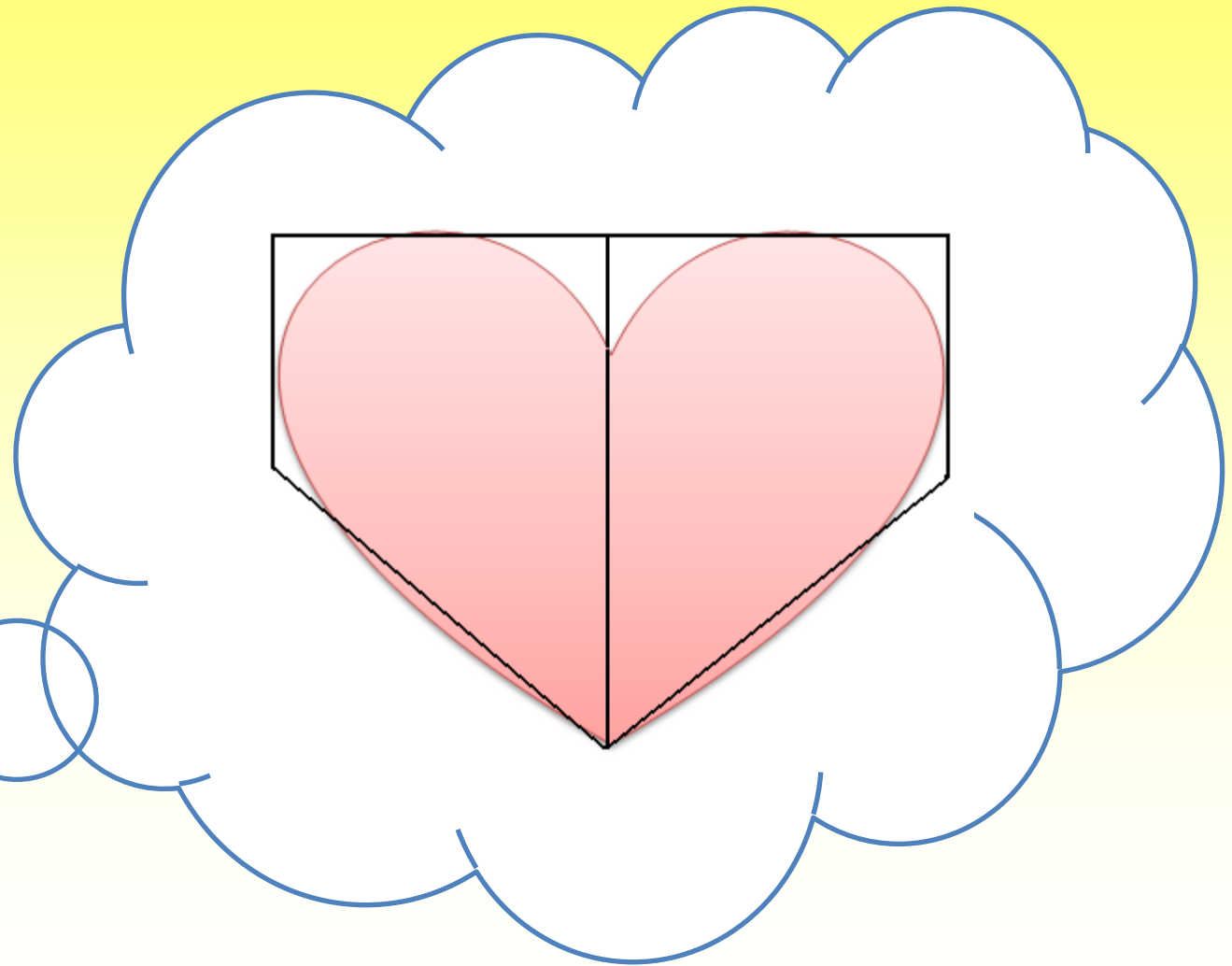
The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

Count square Method



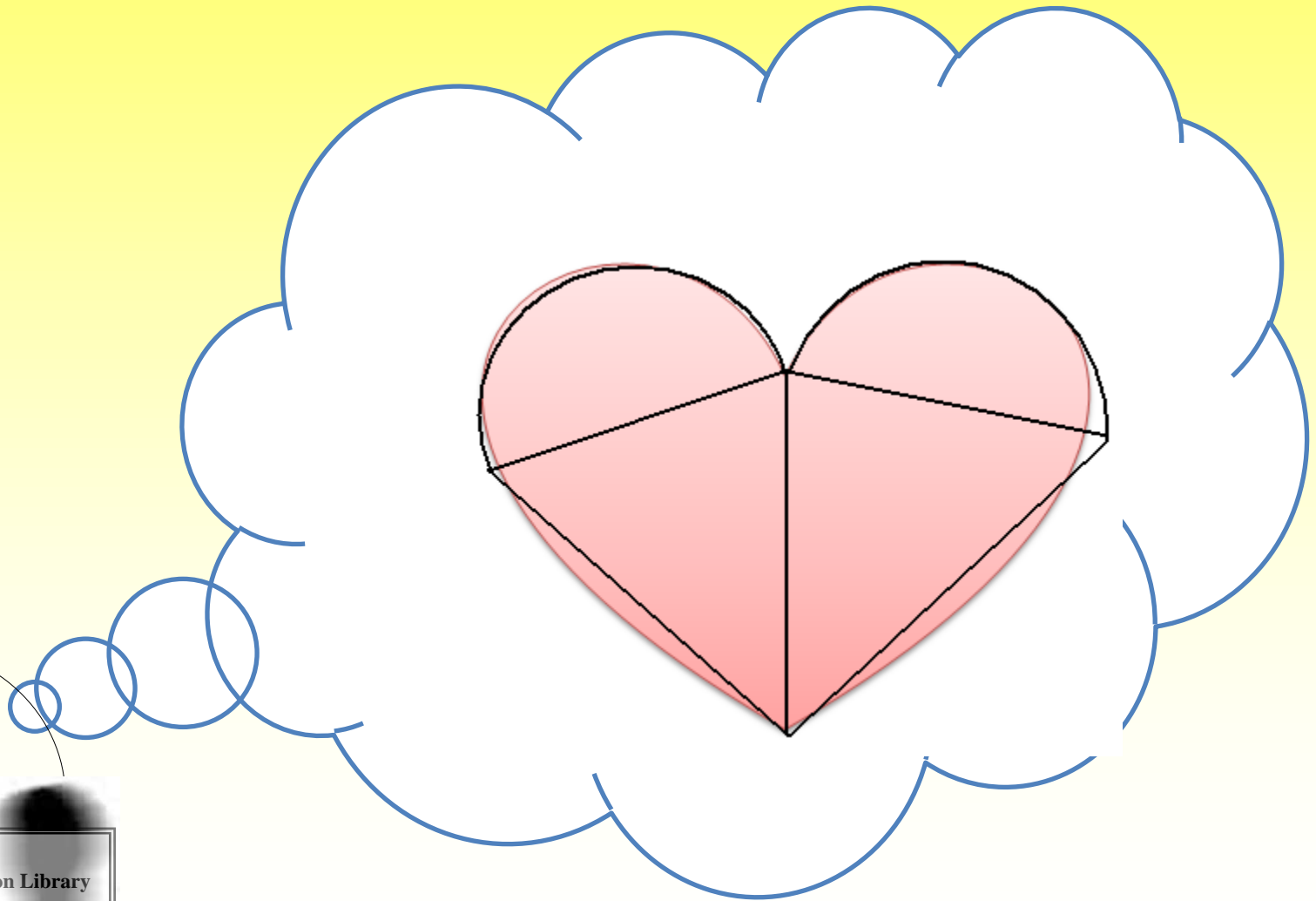
Polygon Approx. Method



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

Dissection Method



The Hong Kong
Institute of Education Library

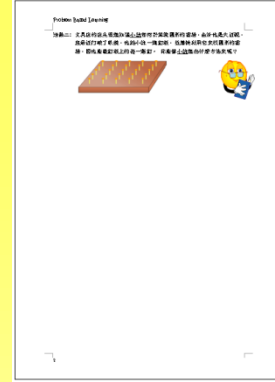
For private study or research only.
Not for publication or further reproduction.

Designing problem scenarios

- **Problem structure**

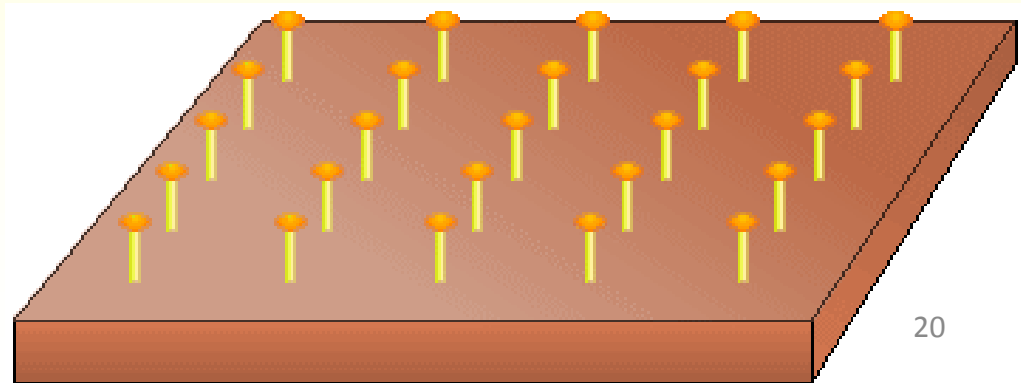
- ill-structured
- Open-ended
- Problem must raise the concepts and principles relevant to the subject matter area





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

Discover an area relation with no. of pins on a geoboard

Designing problem scenarios

- **Problem structure**

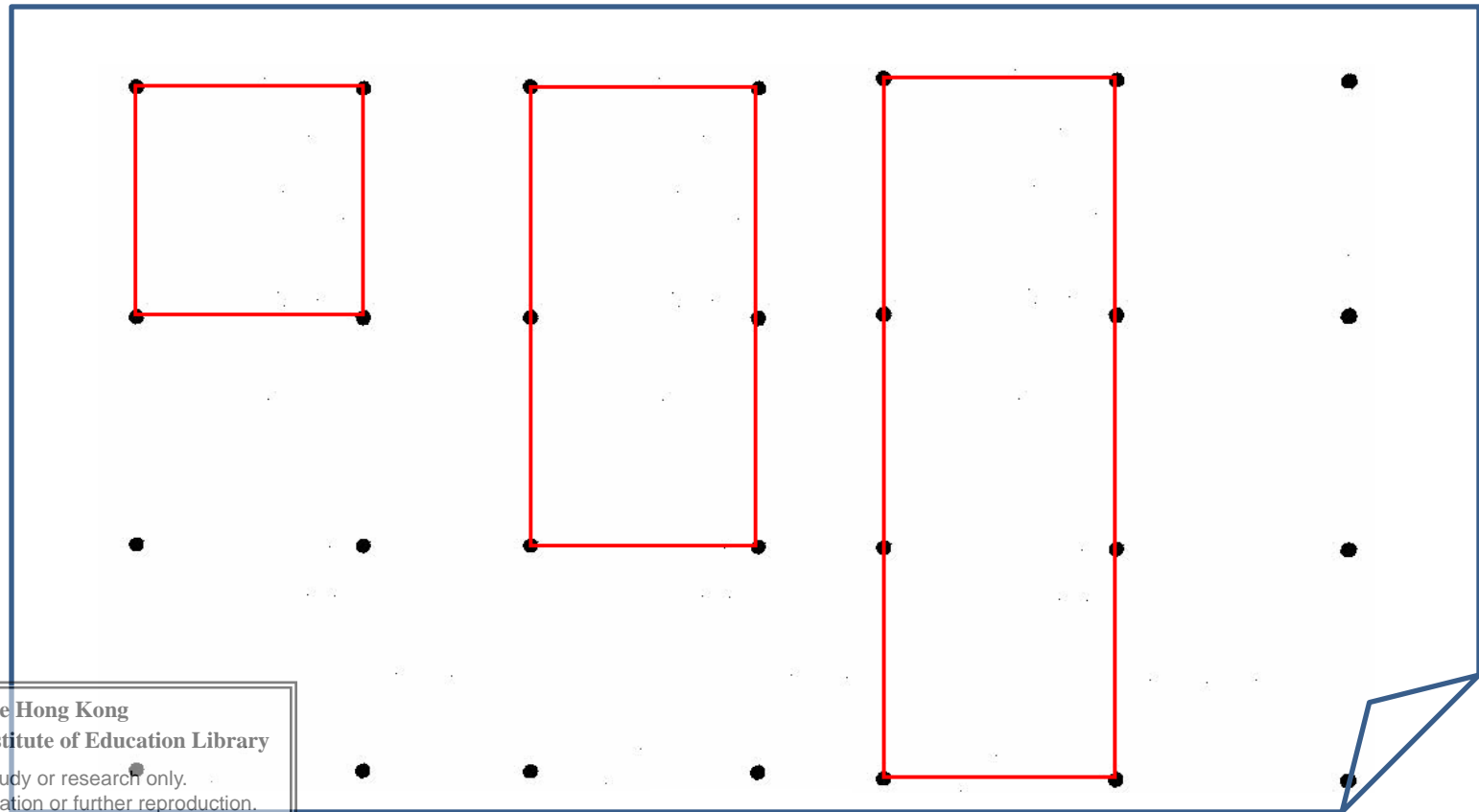
- ill-structured
- Open-ended
- Problem must raise the concepts and principles relevant to the subject matter area
- It encourages students to learn new concepts when solving problems



Results

Group 1

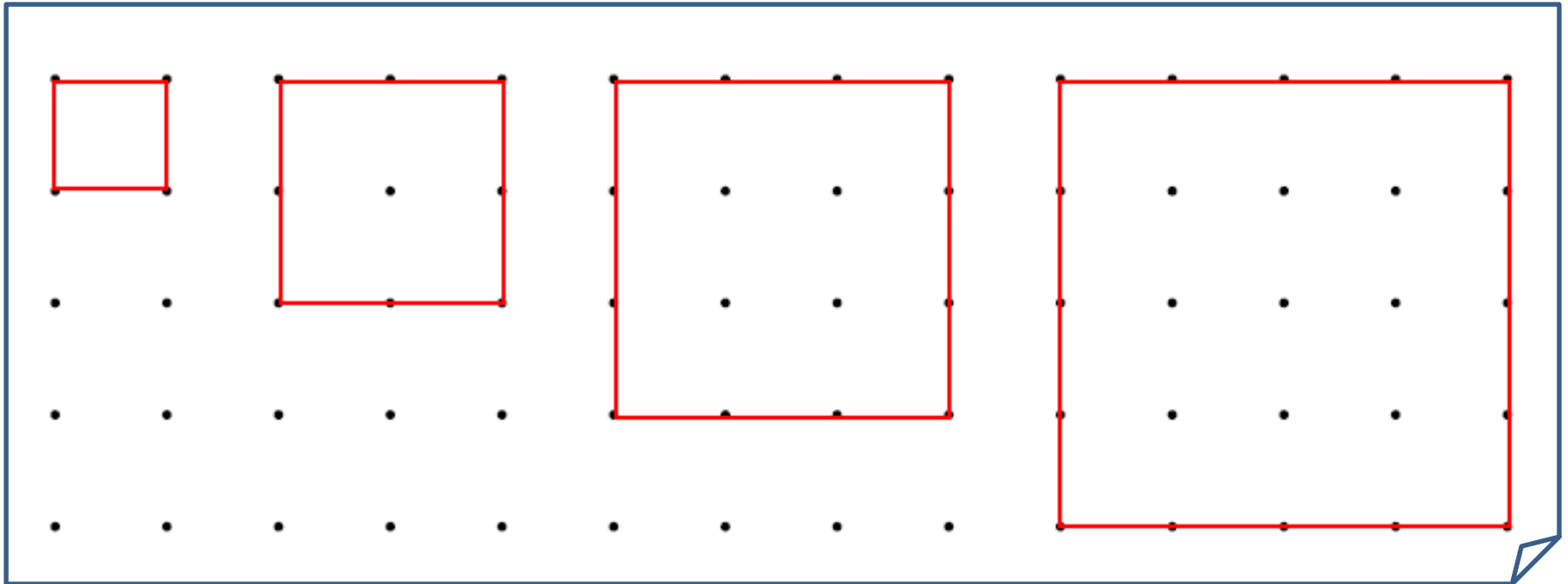
$$\text{Area} = \frac{\text{total points}}{2} - 1$$



Results

Group 2

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

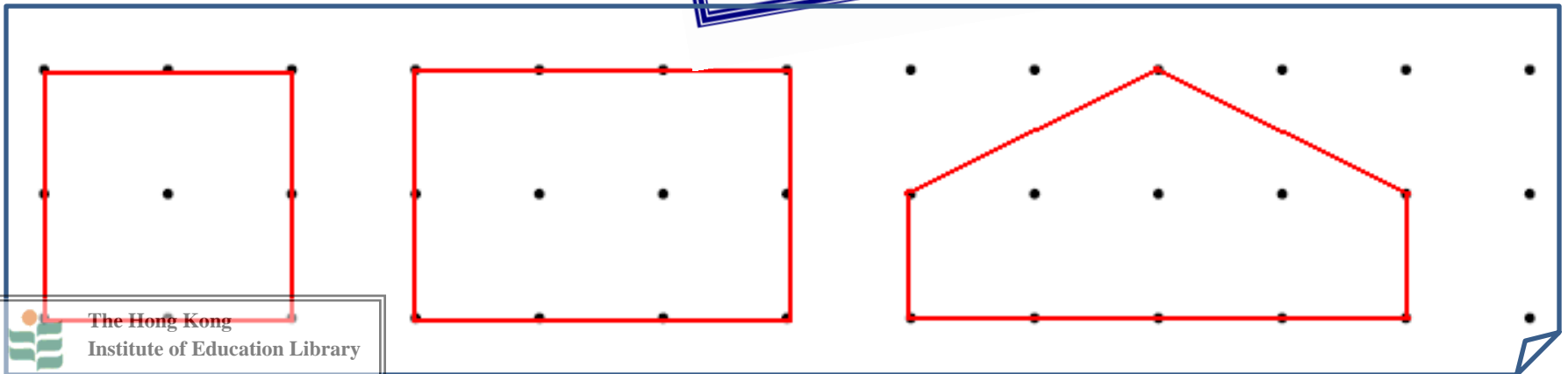


Results

Group 2 & 3

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

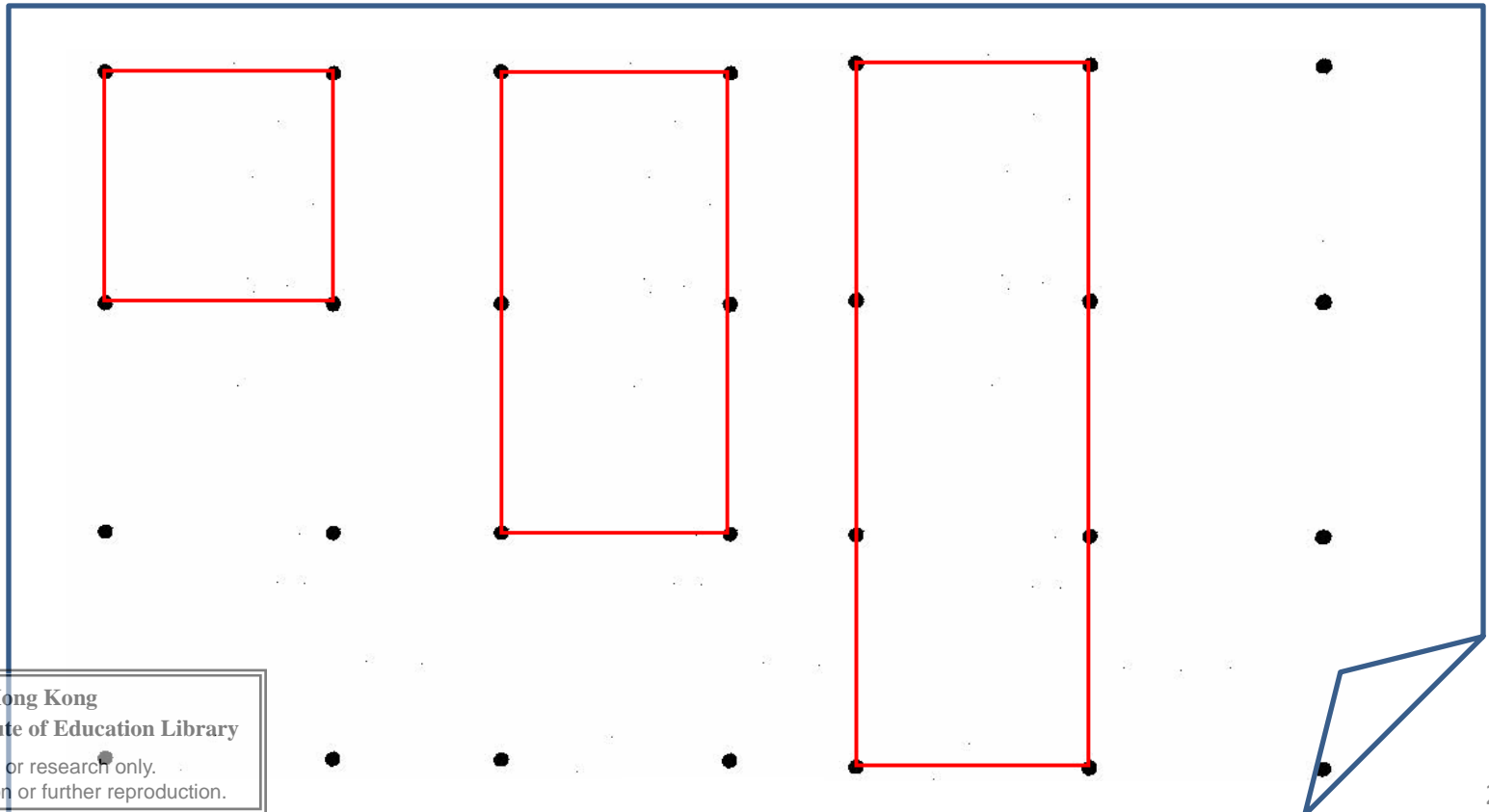
Pick's formula!



Results

Group 4

$$\text{Area} \times 2 + 2 = \text{total points}$$



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.

Designing problem scenarios

- **Problem structure**

- ill-structured
- Open-ended
- Problem must be related to concepts and principles in the subject matter area
- It encourages students to learn new concepts when solving problems

Learn area formula on geoboard



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



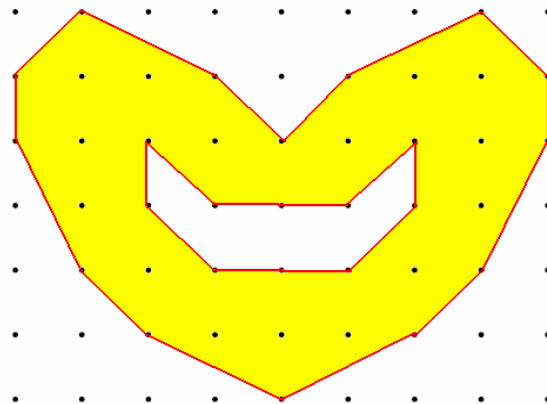
Limitation

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

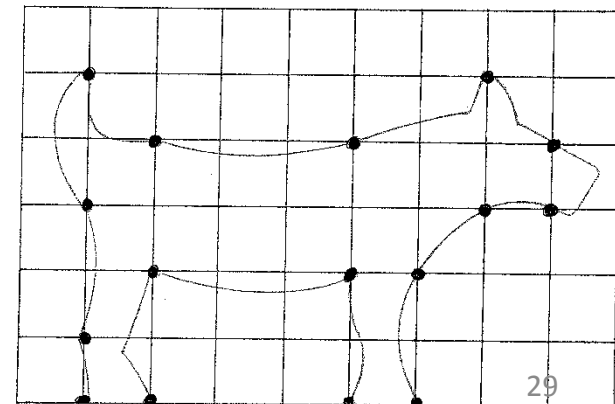
Possible Solution

- Prepare one to two more applications for them to tackle.

鞏固活動一：試找以下圖形陰影部份的面積。



鞏固活動二：試找以下圖狗形圖面積的近似值。



Thank You !



The Hong Kong
Institute of Education Library

For private study or research only.
Not for publication or further reproduction.