Metacognitive Strategies to support Critical and Creative Thinking

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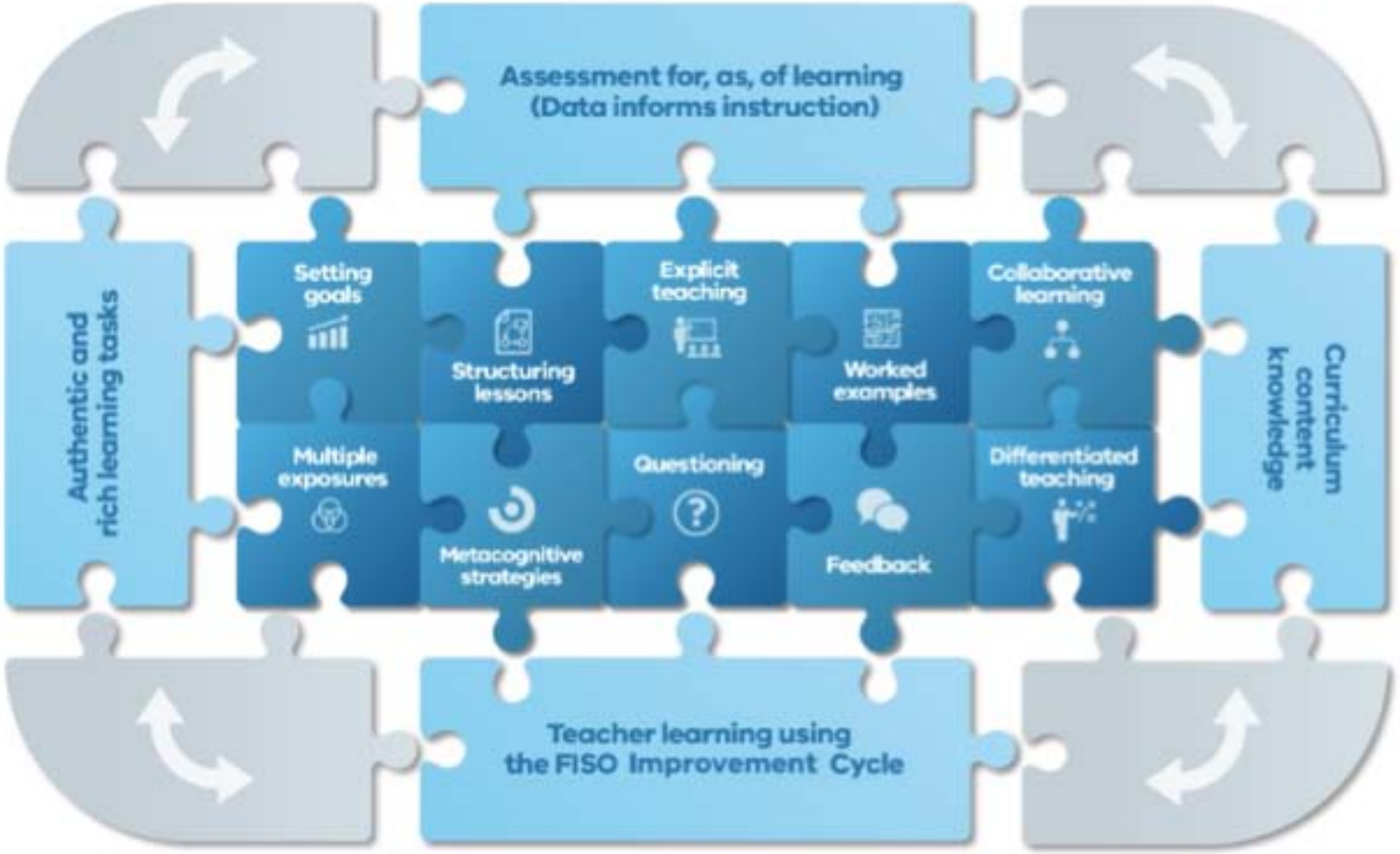
Focus of this session

This session will focus on:

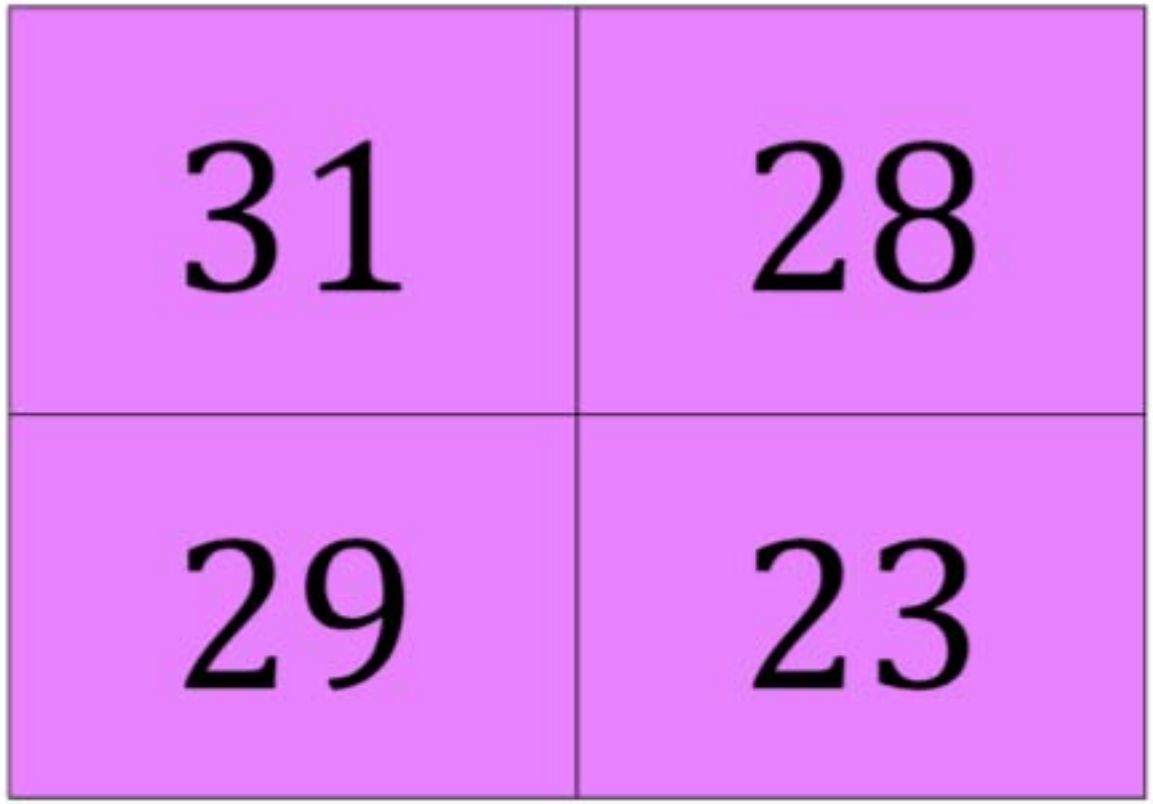
- The development of tasks and questions to develop students critical and creative thinking, with a focus on metacognitive strategies and reasoning.
- How to structure a problem solving lesson to allow students to reflect on their own strategies and thinking and trial different strategies to solve problems based on the strategies of others.
- How a Professional Learning Team can plan and assess students critical and creative thinking.

Framework for Improving Student Outcomes
https://www.education.vic.gov.au/school/teachers/management/improvement/Pages/improvement-model.aspx

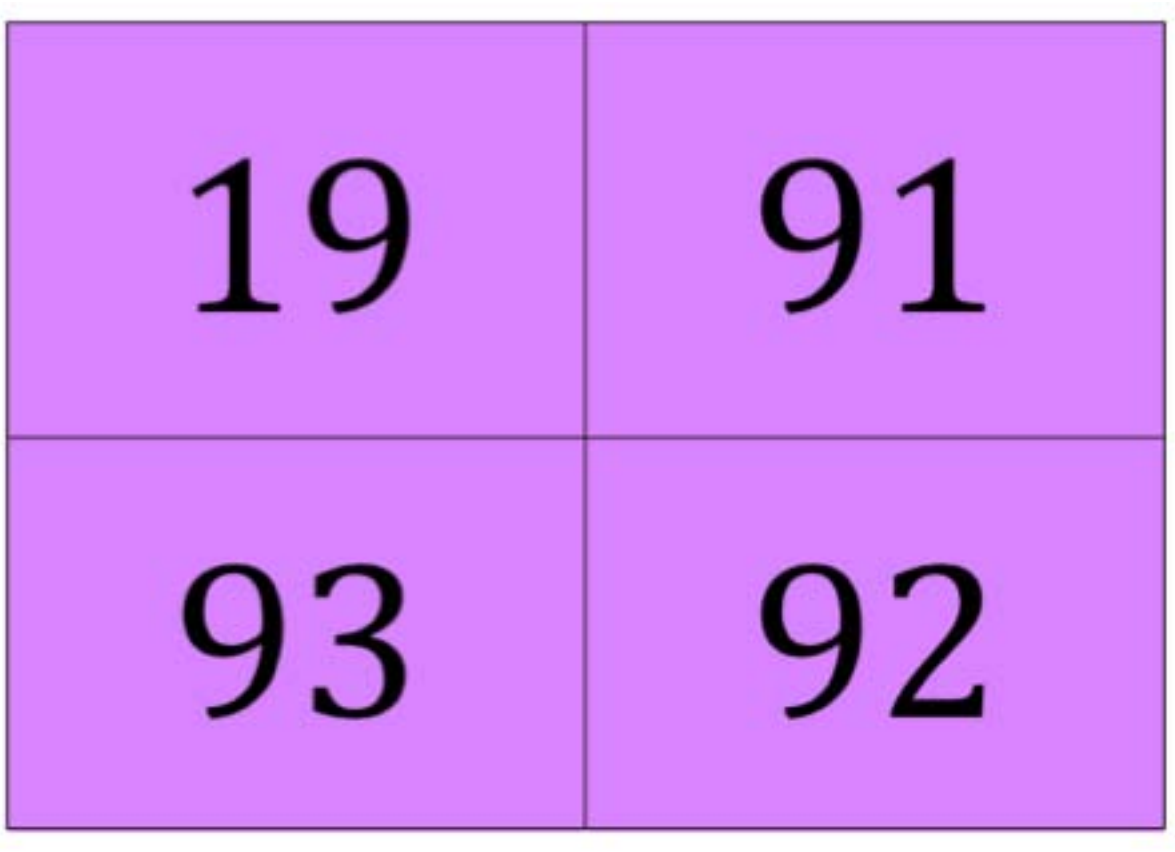


High Impact Teaching Strategies
https://www.education.vic.gov.au/school/teachers/teachingresources/practice/improve/Pages/hits.aspx

Warm Up



Warm Up



How does this warm up foster CCT?

- Encourages students to think for themselves
- Create their own reason for their answer
- No ‘right or wrong’ answer- many different interpretations

WHAT IS METACOGNITION IN MATHS?

'Thinking about thinking'

AWARENESS

Students are made aware of the thinking process so they have control over their own learning

MOTIVATION

Students manage their own motivation towards learning

STRATEGIES

Students are encouraged to use their own strategies, which may link to prior knowledge or previous learning

EXPLICIT

Metacognitive strategies are explicitly taught to students, and modelled through explicit teaching

COMPARE AND CONTRAST

Students are encouraged to compare strategies, to see the similarities and differences

REFLECTION

Students are encouraged to reflect critically on the strategies they have used, identifying if they are efficient or not

How can a Problem Solving lesson be structured to develop CCT?

INTRODUCE THE PROBLEM

Read through the problem with the students, ensuring you make a real life connection to the problem.

It is important not to tell students how to solve the problem.

INDEPENDENT SOLVING

Students work independently to solve the problem using their own strategy or strategies. Work with students who require assistance.

RECORDING THINKING

Encourage students to record their thinking and to justify their thought process. This will make it easier for them to share with the class.

SHARING OF STRATEGIES

Whilst students are working, identify the different strategies students are using and decide how to structure the sharing of these strategies. Encourage students to share their strategy with the class , and allow others to ask questions of their work.

COMPARE AND CONTRAST

Highlight similarities and differences between students strategies, and encourage students to reflect on the different strategies used.

REFLECT ON LEARNING

Allow students to reflect on the learning which has taken place during the lesson, and to identify the efficient strategies they have seen.

What do we mean by ‘Strategies?’

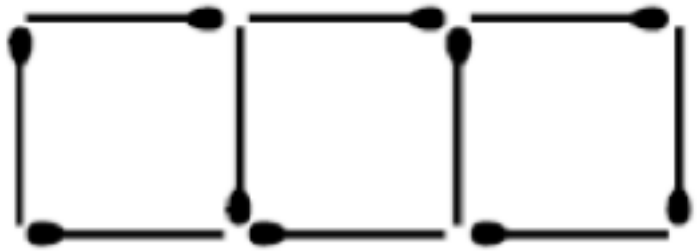
Miss McKee was going shopping to buy a new puppy! When she looked inside the puppy pen, she could see 7 puppies looking at her. How many eyes could she see?

How could this be solved?

Model All (counters)	Draw All (puppy)	Draw all (dot)
Additive- 1+1+1+... (x)	Additive- 1+1+1... correct)	Additive- 2+2+2 (x)
Additive- 2+2... (Correct)	Additive- 7+7 (with expl)	Number Sentence 7x2=14

Let’s do a Problem Solving lesson

Miss McKee was planning to build a fence in her backyard. She needed to work out how many bits of wood she needed to make her fence, so she decided to make it first with Matchsticks. She made 3 sections of fence with her matchsticks. How many matchsticks would she need altogether to make 9 sections of fence?



How many different strategies could be used?

Why is it important to compare and contrast strategies?

Make all (28)	Draw all (28)	Repeated add (3+3…1)	Repeated add (1+3+3..)
4+3+3+3+_	3x3 (using picture) *incorrect	3x3-2 (using picture) *incorrect	Skip Count (4,7,10)
Table (squares/sticks)	1+(3x9)	4x9 (incorrect)	3x9+1

How can a PLT Plan and Assess Students CCT?

Working as a PLT

- Create one good question
- Decide on all the possible solutions
- Create a developmental continuum of the strategies- some may be ‘equal’
- Deliver the lesson
- Bring back work samples
- How many students are using efficient strategies? Who are these students?
- What can we do for those students who are still not thinking critically- how can we scaffold their learning?

CREATING A PROBLEM SOLVING QUESTION AT WEDGE PARK PRIMARY SCHOOL

1

IDENTIFY THE SKILL

related to the problem and the purpose of the problem

e.g. Addition of 2 digit numbers where the result bridges over 100

2

CREATE A QUESTION

with a focus on understanding or fluency related to the chosen skill

e.g. 55+59

3

USE THIS PROBLEM

as a basis for your problem solving question. This may include

- Adding in irrelevant information
- Making the problem based on missing information
- Ensuring the problem is in a relatable context for the students to solve
- Making the problem a multi-step problem

e.g. A teacher was counting how many pencils were in 4V's classroom. In one pencil tub, she counted 55 pencils. She forgets how many were in the other pencil tub, but she remembered that altogether there were 114 pencils. How many pencils were there in the pencil tub?

4 ANSWER THE PROBLEM

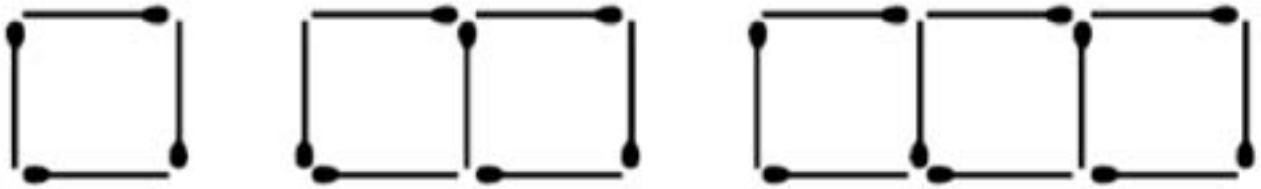
and decide how many different ways students could solve this problem

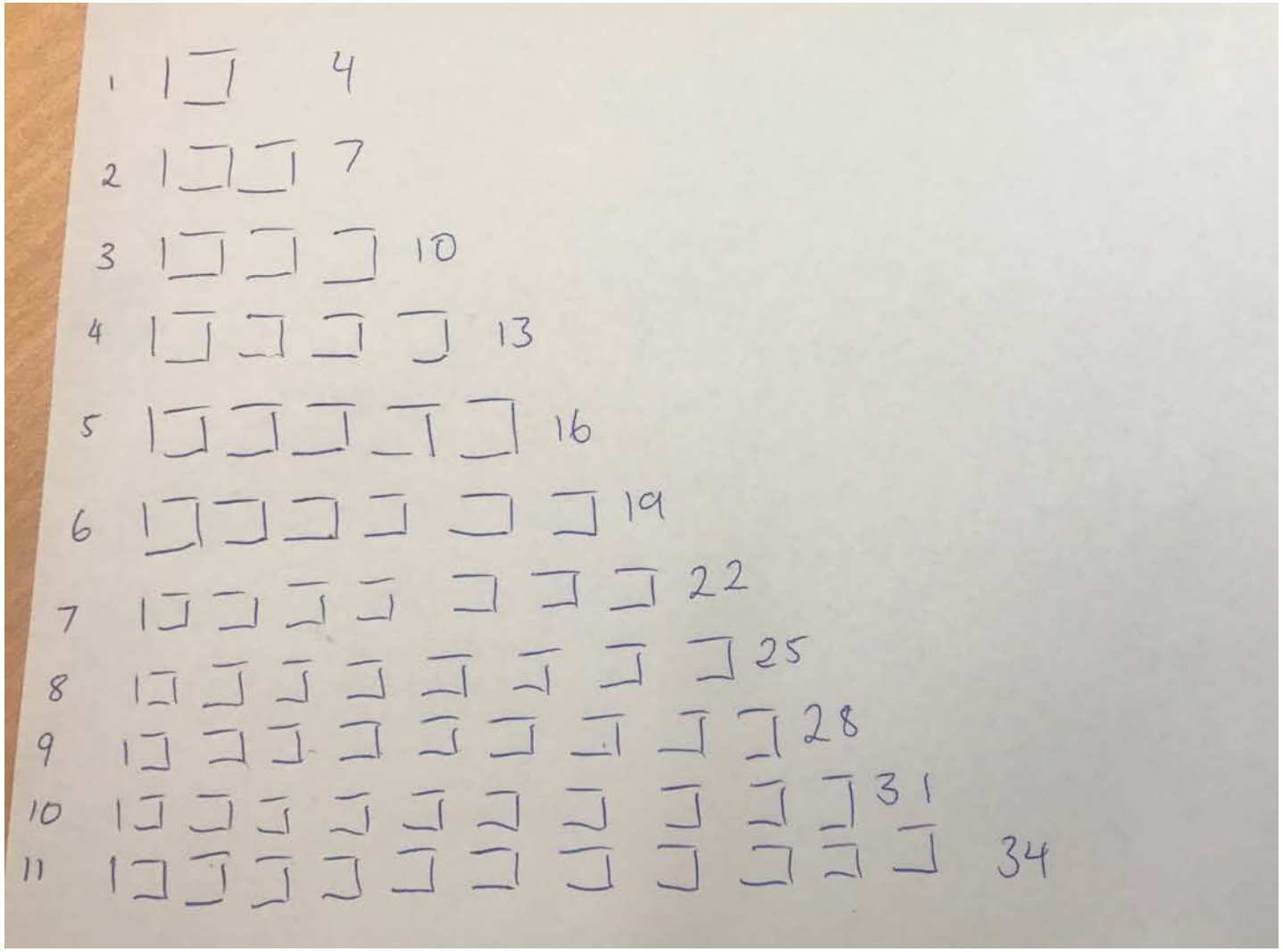
- Is there only one way? This won't be an effective Problem Solving question
- Are the strategies able to be organised sequentially in terms of efficiency? This will assist in identifying student understanding during Problem Solving

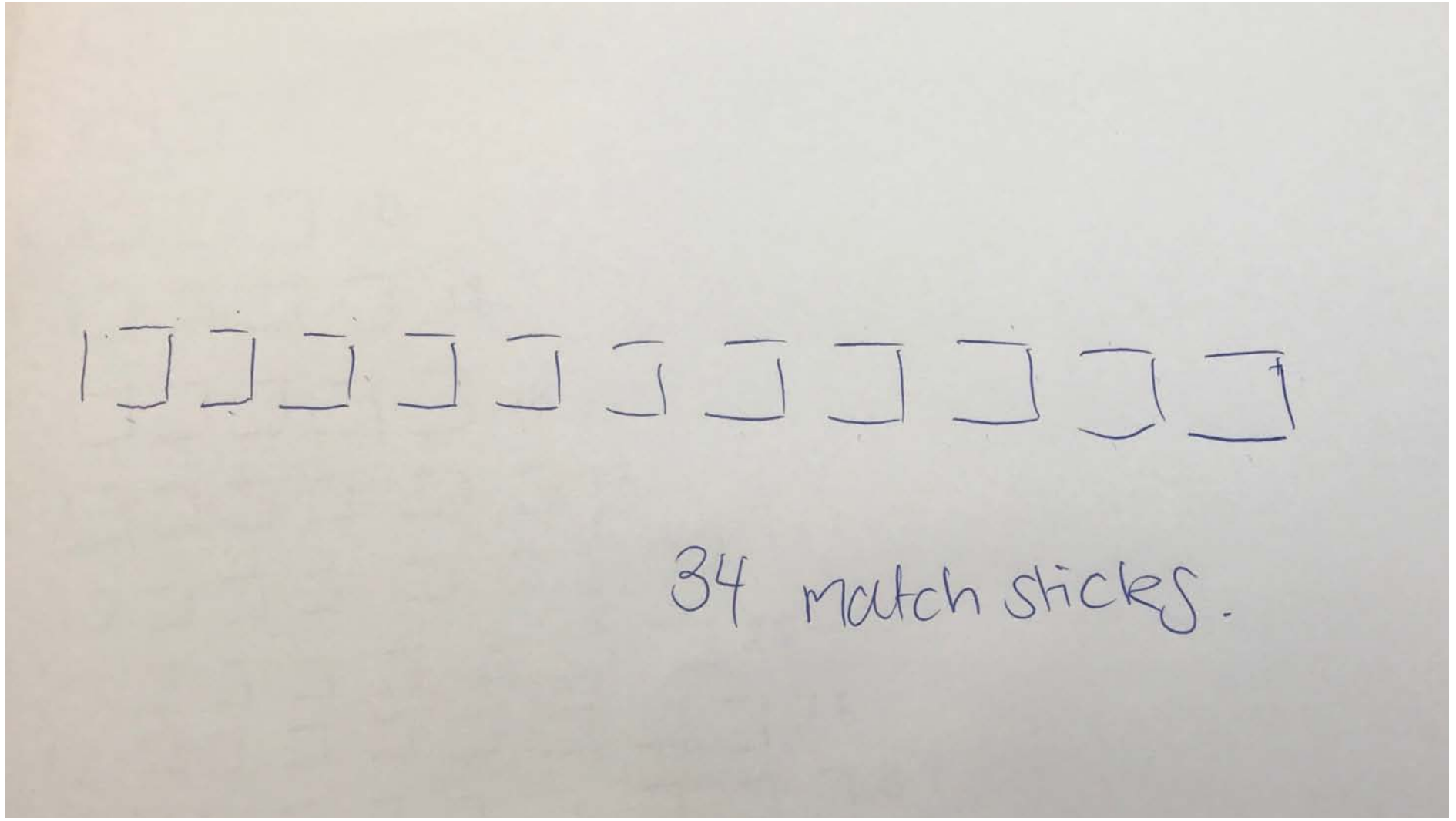
e.g.

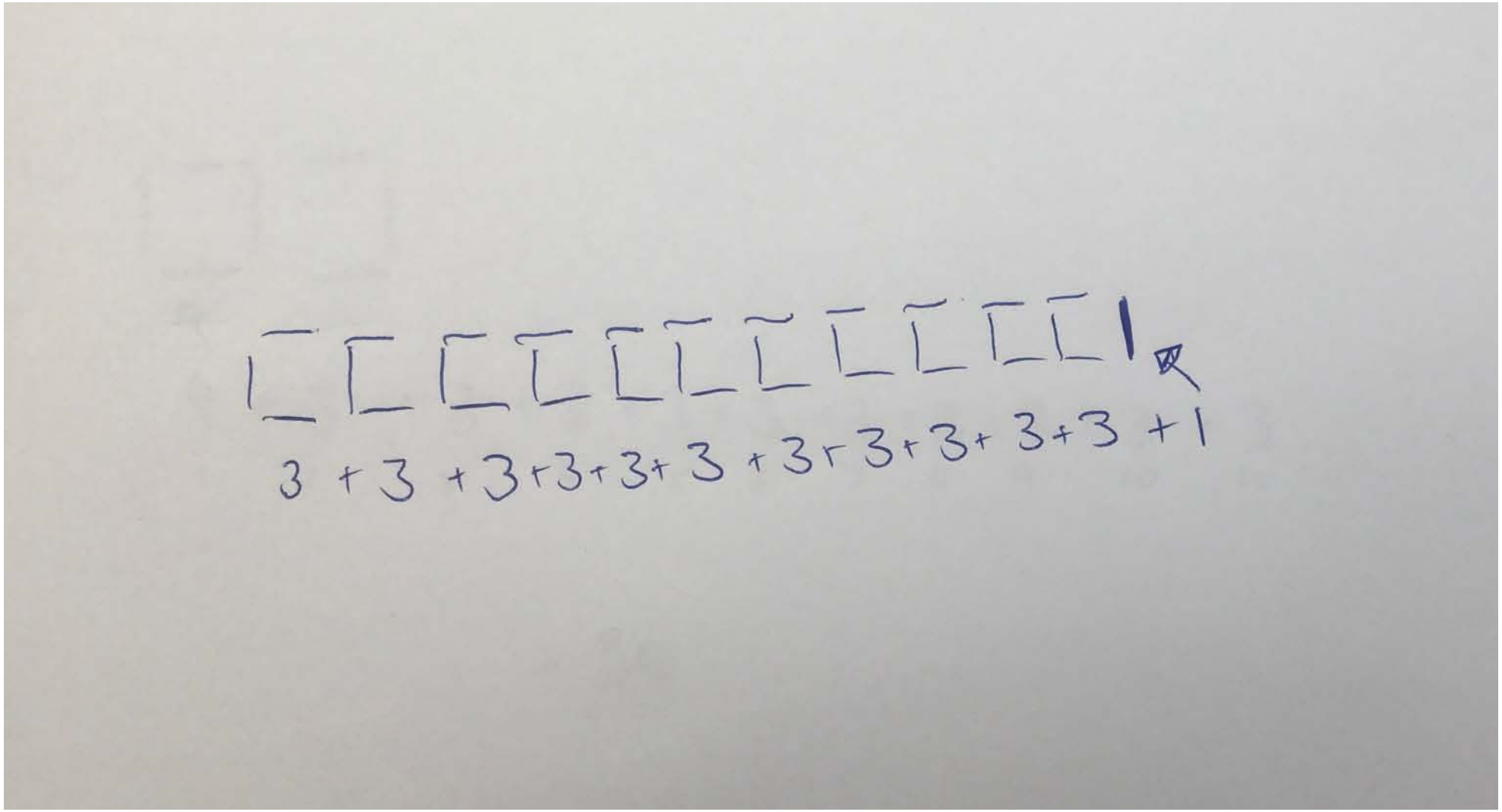
- Students could model the problem using MAB
- Students could draw the problem
- Students could use a number line and the 'jump' strategy
- Students could count up in 10's and then 1's
- Students could count down in 10's and then 1's
- Students could use the subtraction algorithm
- Students could write a number sentence to show the missing number: 55+ ?=114

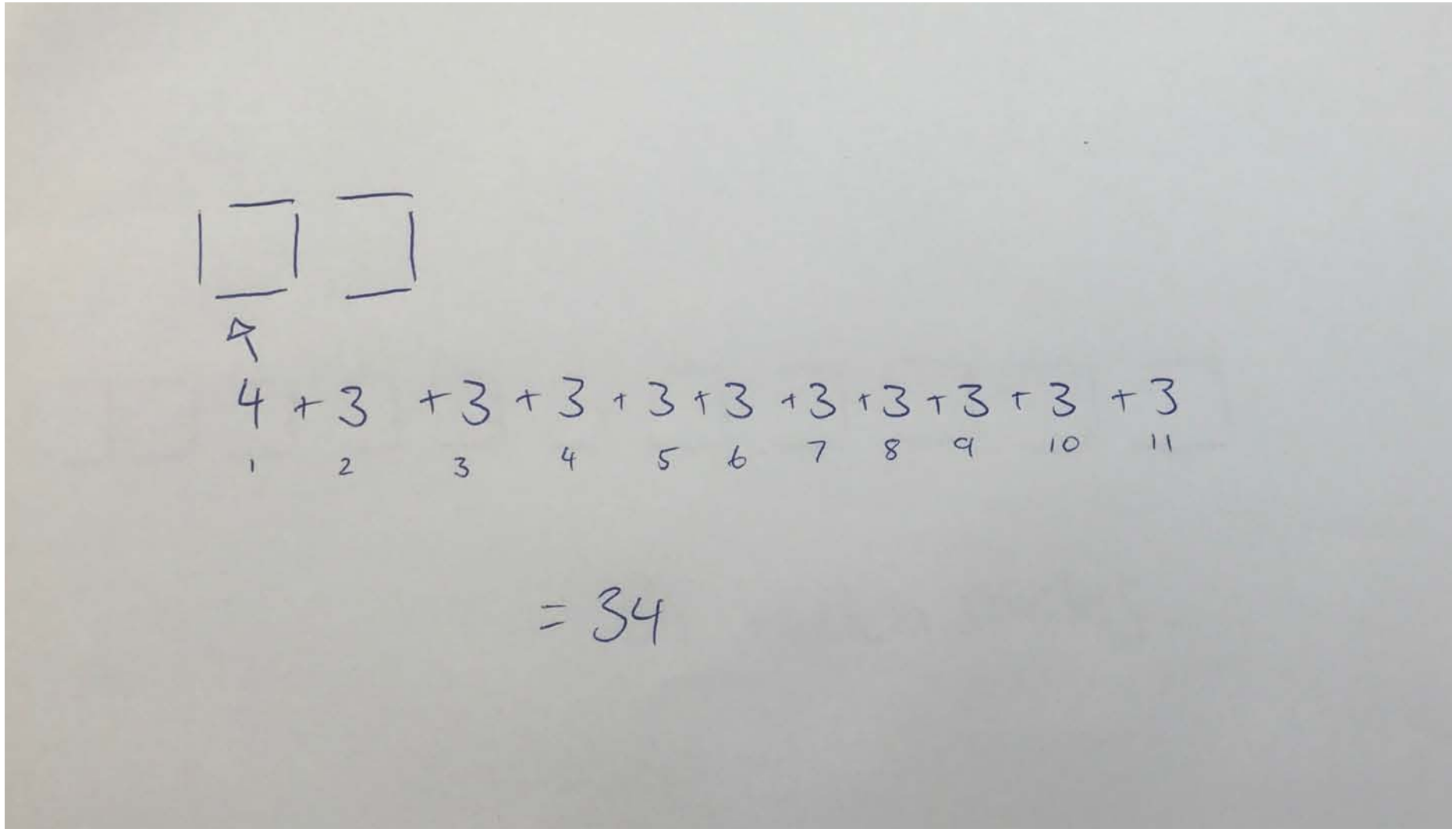
Mr Schwartz loves making patterns! He was using sticks to make a square pattern. To make one square, he needed 4 sticks. To make 2 squares. he needed 7 sticks. How many sticks would he need to make 11 squares?

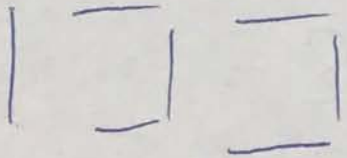



1 4
2 7
3 10
4 13
5 16
6 19
7 22
8 25
9 28
10 31
11 34


34 match sticks.


3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 1


4 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3
1 2 3 4 5 6 7 8 9 10 11
= 34



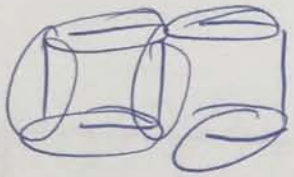
4 +3 +3

4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34

squares	1	2	3	4	5	6	7	8	9	10	11
stichs	4	7	10	13	16	19	22	25	28	31	34

1 + 11 × 3

= 34 sticks.

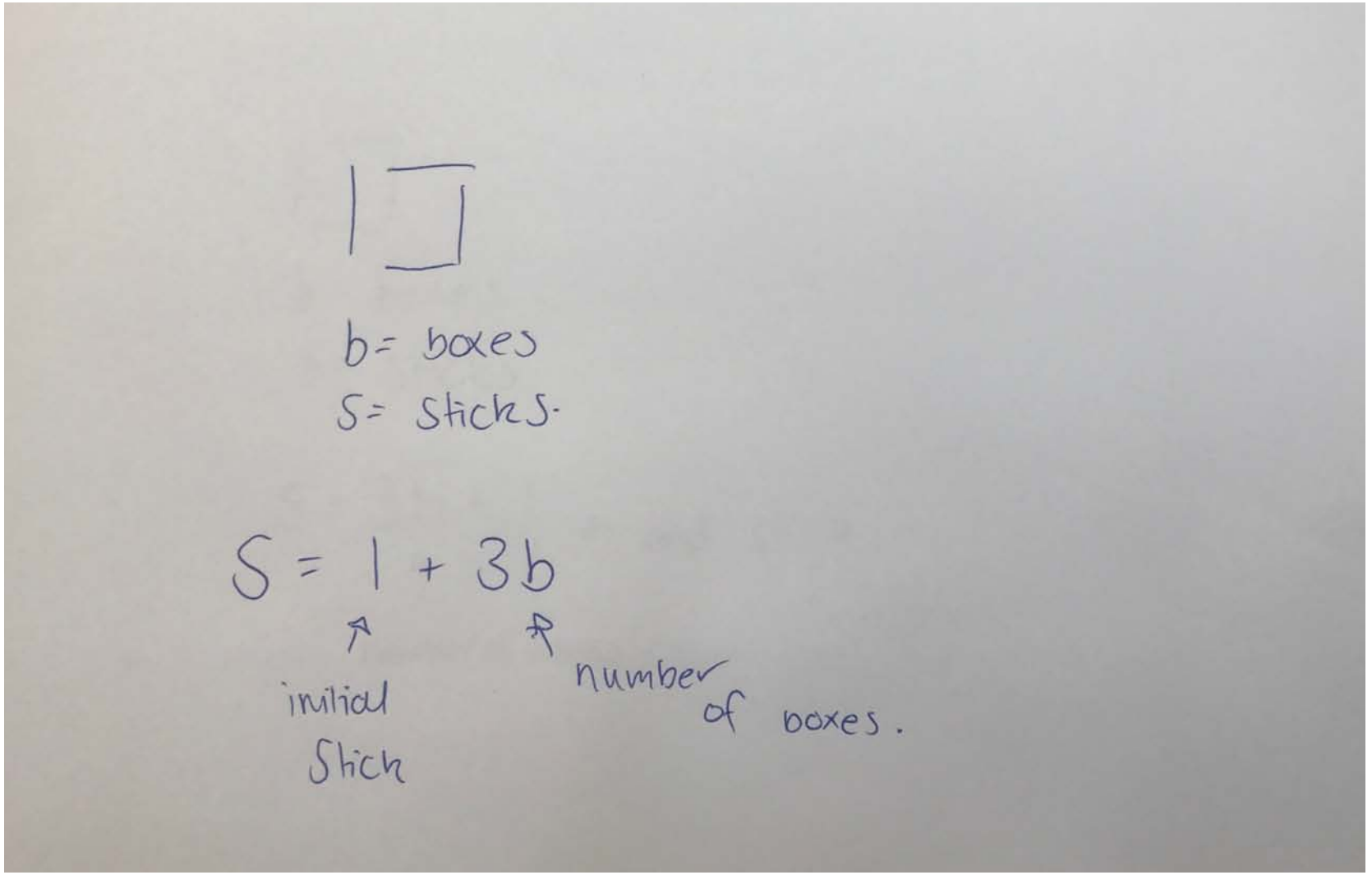


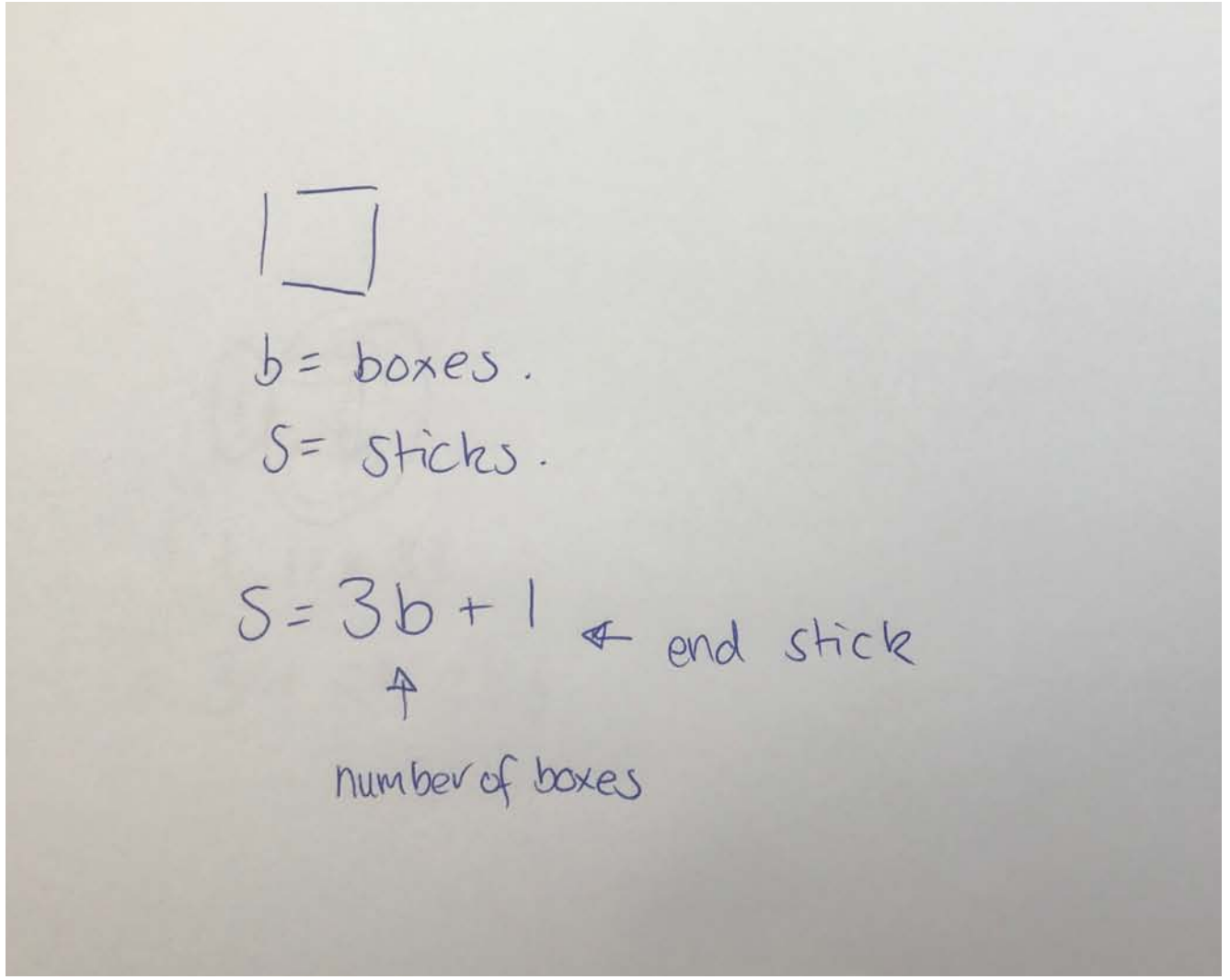
..... 1

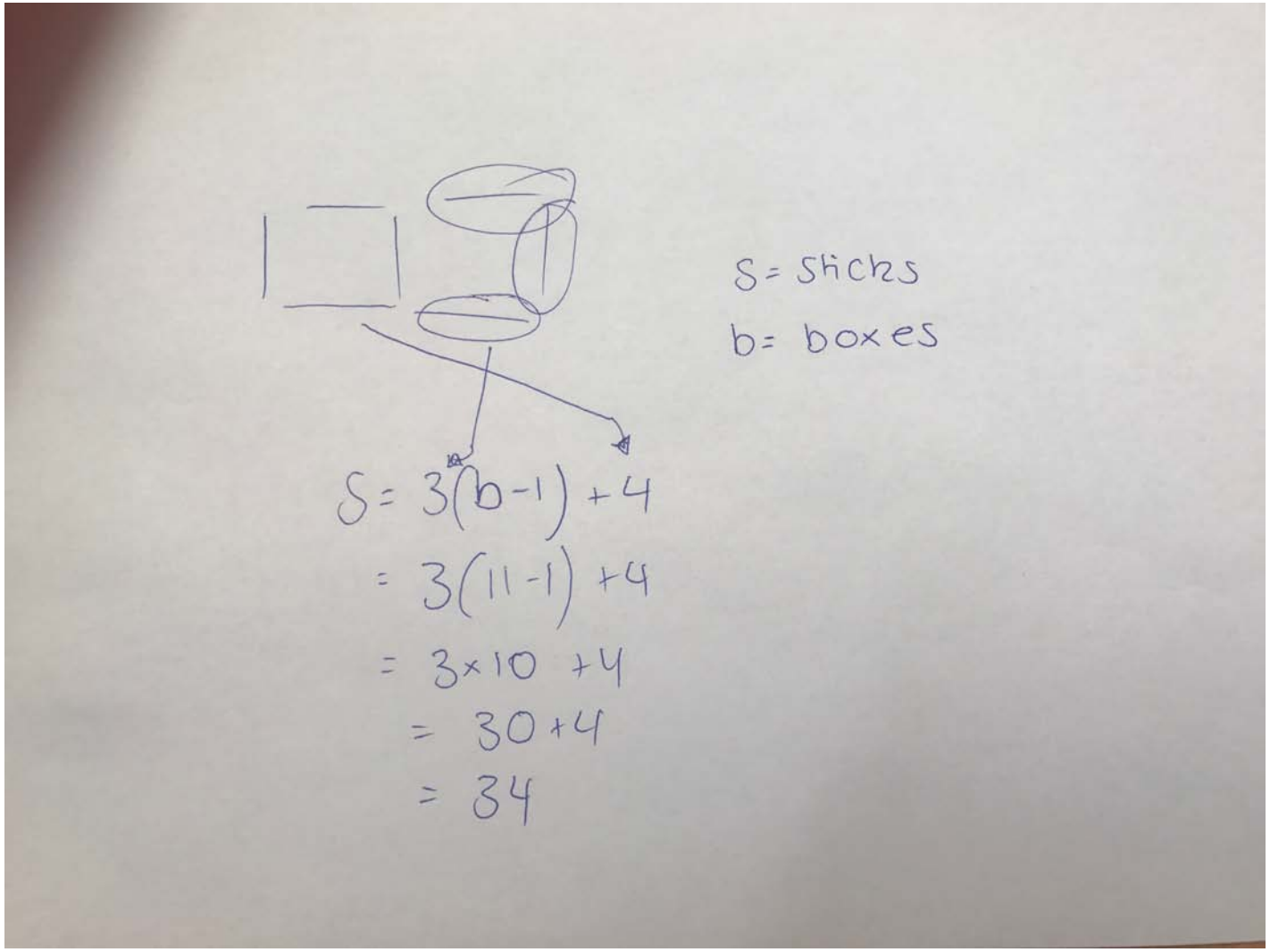
3×11

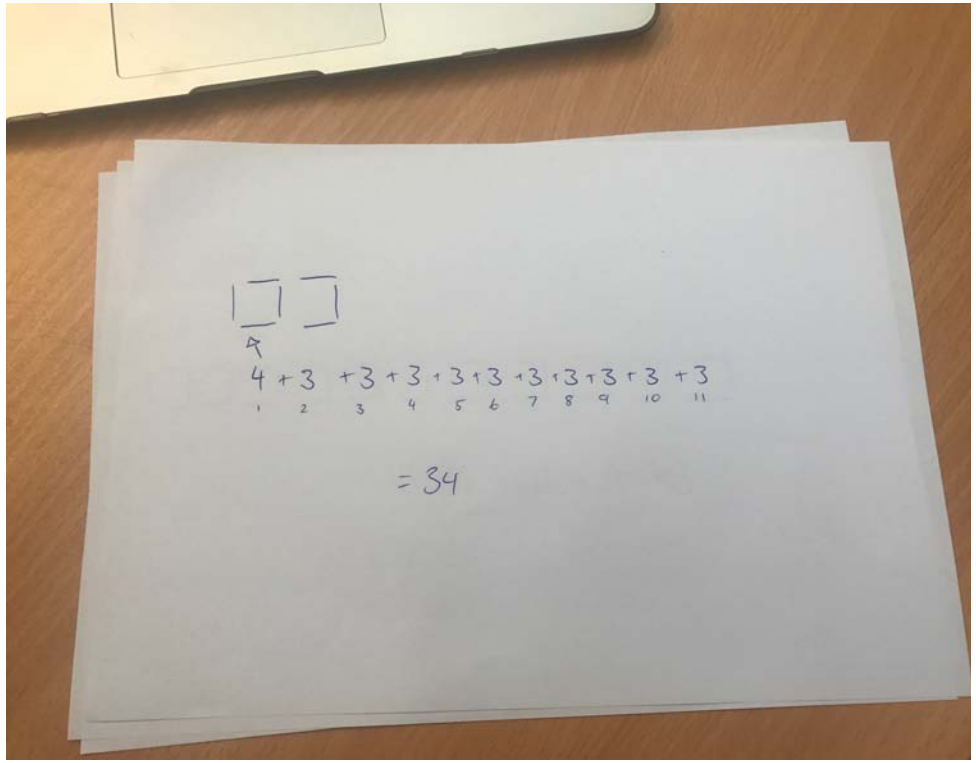
$= 33 + 1$ for end stick

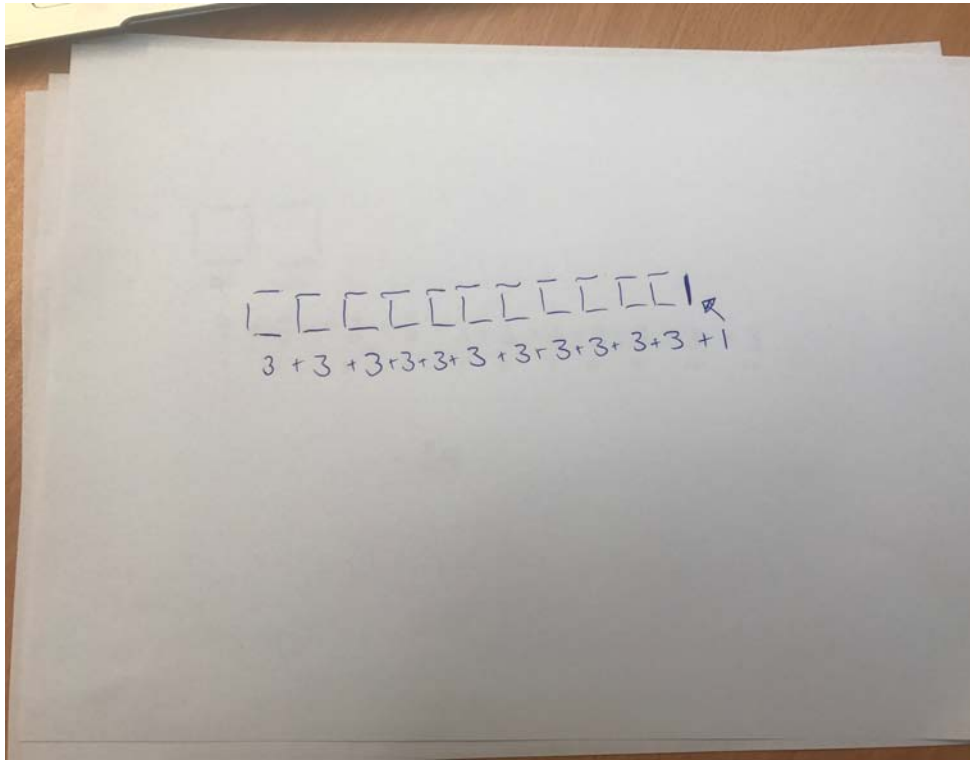
$= 34$ sticks.


b= boxes
S= sticks.
S = 1 + 3b
initial stick
number of boxes.


b = boxes.
S = sticks.
S = 3b + 1
end stick
number of boxes


S = sticks
b = boxes
S = 3(b-1) + 4
= 3(11-1) + 4
= 3×10 + 4
= 30 + 4
= 34





Similarities between strategies

WHAT DO THESE STRATEGIES HAVE IN COMMON? HOW ARE THEY DIFFERENT?

b = boxes.

S = sticks.

$S = 3b + 1$ ← end stick

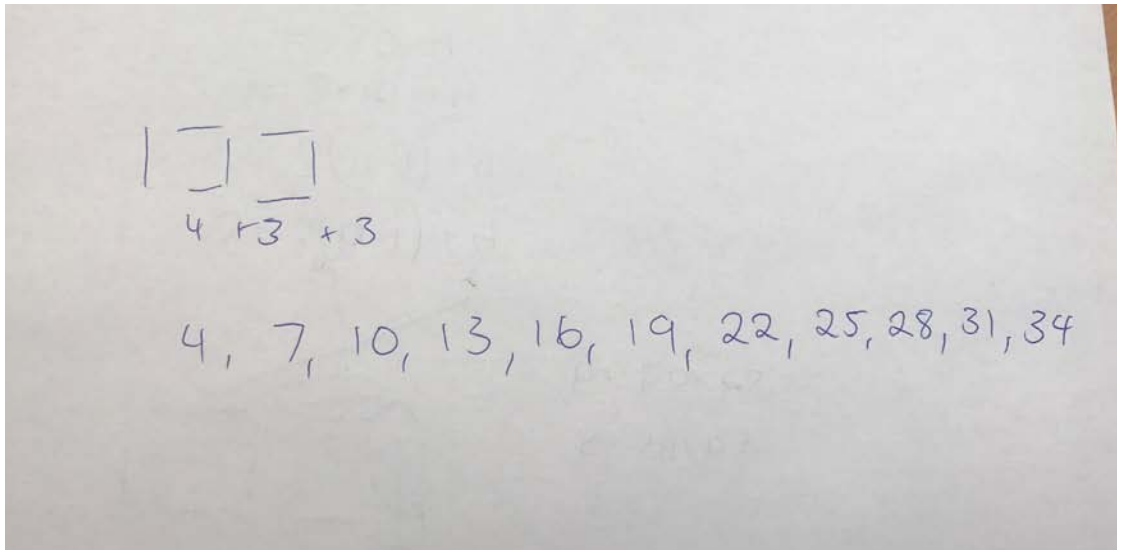
↑ number of boxes

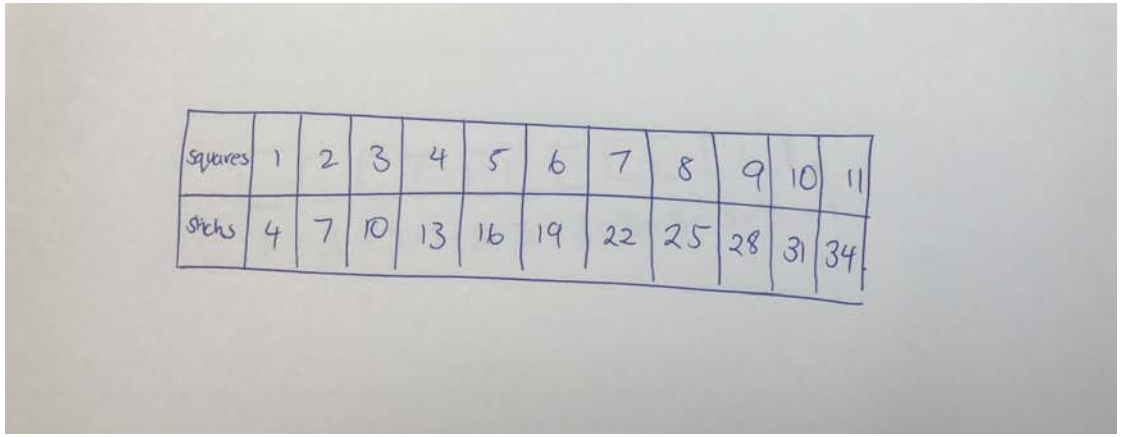
1

3×11

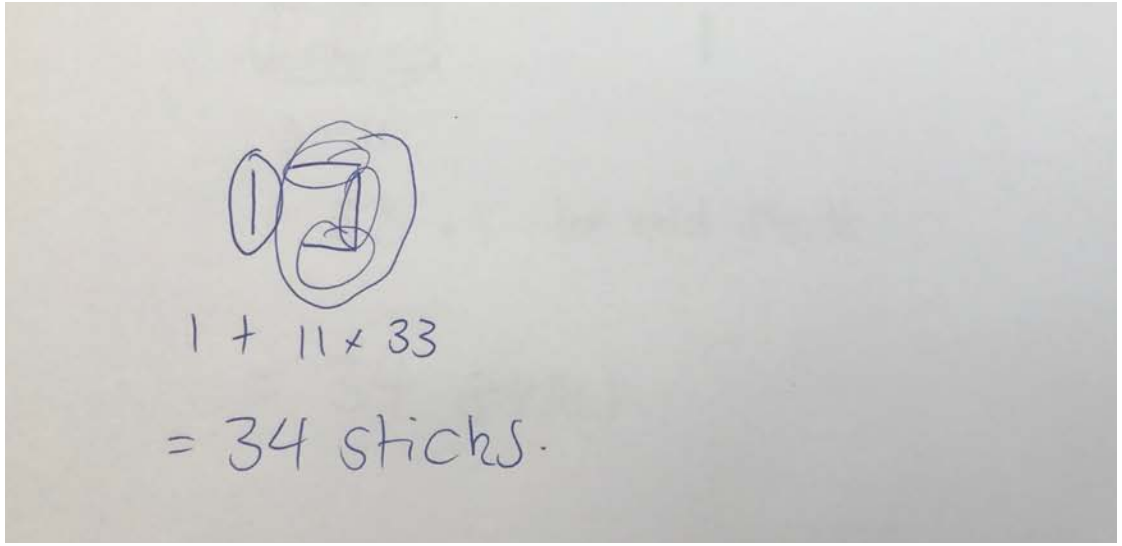
$= 33 + 1$ for end stick

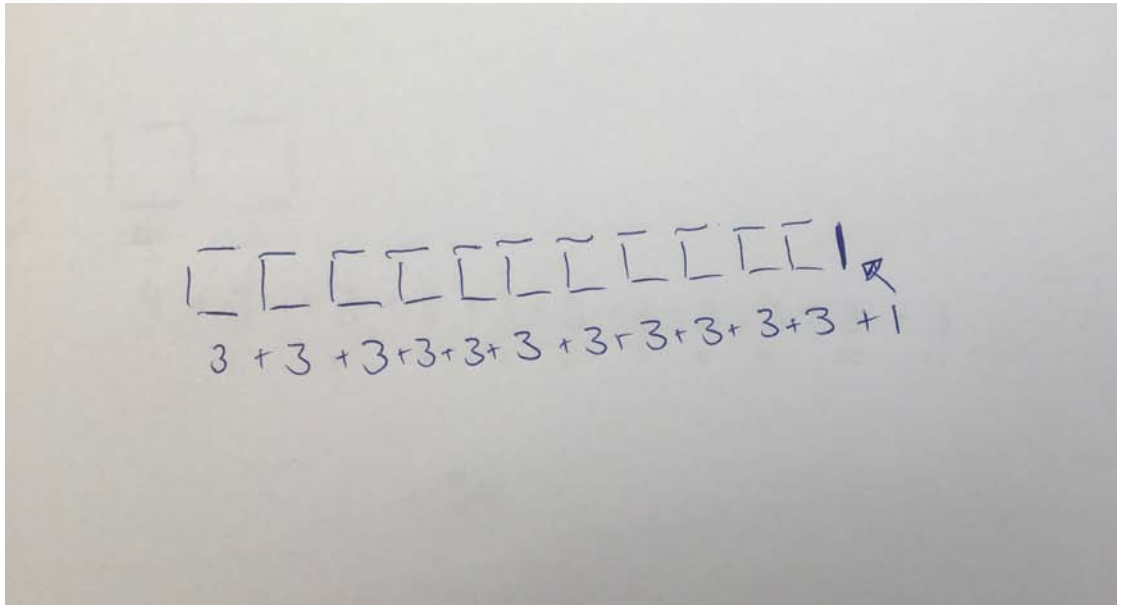
$= 34$ sticks.





squares	1	2	3	4	5	6	7	8	9	10	11
sticks	4	7	10	13	16	19	22	25	28	31	34


1 + 11 × 33
= 34 sticks.


3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 1

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