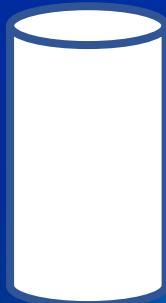




Constructing methods or Using methods – what do students do and learn?

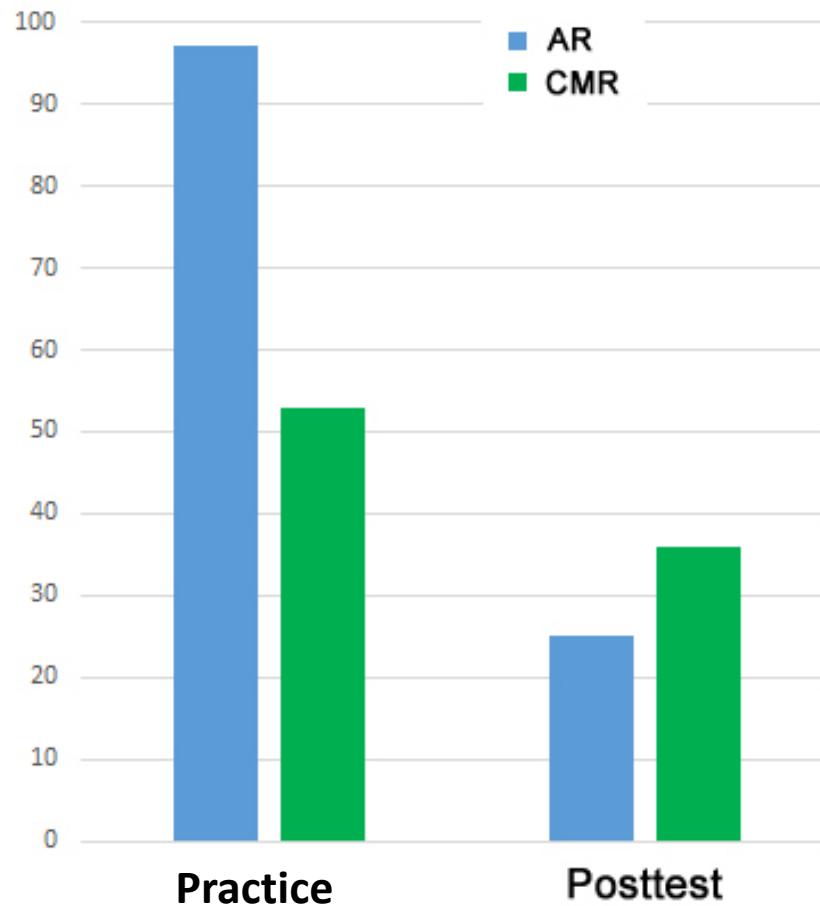
$$x^a + x^b = x^{a+b}$$



$$V = h\pi r^2$$

Carina Granberg

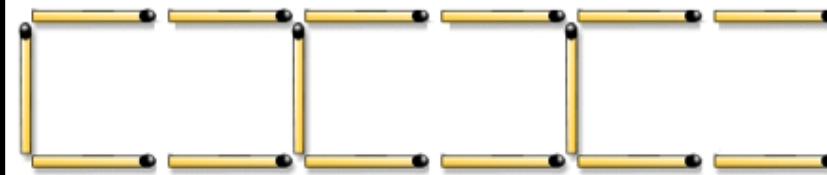
Quantitative data showed



Practice AR-task, method provided

Practice CMR-task, constructing method

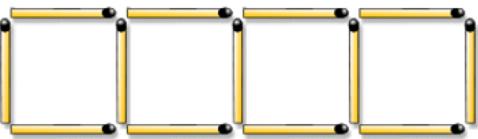
Posttest transfer task



When rectangles are put in a row, it looks like the figure on the right,
16 matches are needed for three rectangles.

How many matches are needed to get 100 rectangles in a row?

Practice AR-task, method provided



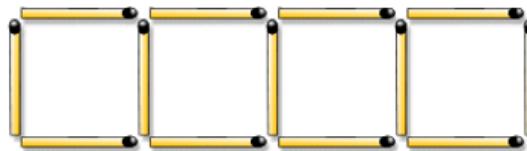
When squares are put in a row, it looks like the figure on the right, 13 matches are needed for four squares.

The number of matches y could be calculated $y = 3x + 1$

Example: If 4 squares > then $y = 3x+1 = 3 \cdot 4 + 1 = 13$ st

How many matches are needed to get 100 squares in a row?

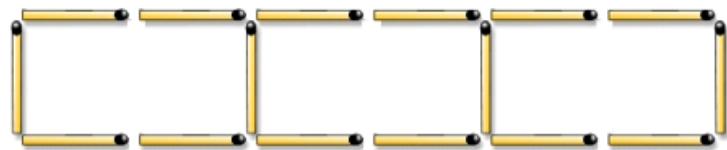
Practice CMR-task, constructing method



When squares are put in a row, it looks like the figure on the right, 13 matches are needed for four squares.

How many matches are needed to get 100 squares in a row?

Posttest transfer task



When rectangles are put in a row, it looks like the figure on the right, 16 matches are needed for three rectangles.

How many matches are needed to get 100 rectangles in a row?

Qualitative Questions

1. What kind of problem solving activities are students engaged in?
(Constructing v/s Using Methods)

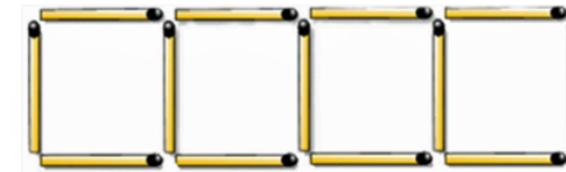
10 students, observations and think aloud protocol, practice and posttest

2. What knowledge do students transfer from practice to posttest?
(Constructing v/s Using Methods)

+ 60 students, completing questionnaires, practice and posttest

1. What kind of problem solving activities are observed?

Activity	Problem-solving process (timeline)
Problem solved	
Verifying	
Planning/Implementing	
Exploring	
Analyzing	
Reading	



When squares are put in a row, it looks like the figure;
13 matches are needed for four squares.

How many matches are needed to get 100 squares in a row?

2. What is transferred from practice to posttest

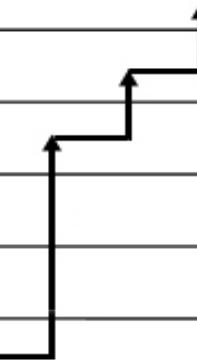
Content			
What is learned and transferred	← Specific → General		
	Procedure Fact Algorithm etc.	Representation Graph Diagram	Principle Understanding Underlying idea

(Barnett & Ceci, 2002, When and where do we apply what we learn?: A taxonomy for far transfer)

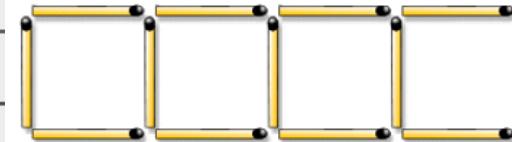
1. ‘Problem’ solving activities, AR, methods provided

Using the method (86%)

Activity	Problem-solving process (timeline)
Problem solved	
Verifying	
Planning/Implementing	
Exploring	
Analyzing	
Reading	



Practice AR-task, method provided



When squares are put in a row, it looks like the figure on the right, 13 matches are needed for four squares.

The number of matches y could be calculated $y = 3x + 1$

Example: If 4 squares > then $y = 3x+1 = 3 \cdot 4 + 1 = 13$ st

How many matches are needed to get 100 squares in a row?

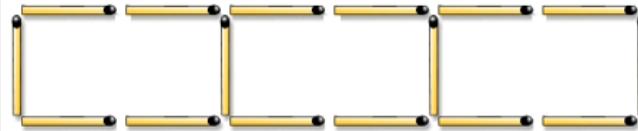
2. What is transferred from practice to posttest

Content			
What is learned and transferred	Procedure Fact Algorithm etc.	Representation Graph Diagram	Principle or Heuristics Understanding Underlying idea
	Specific	General	

Transfer: Nothing

The formula as a procedure

Posttest transfer task



When rectangles are put in a row, it looks like the figure on the right,
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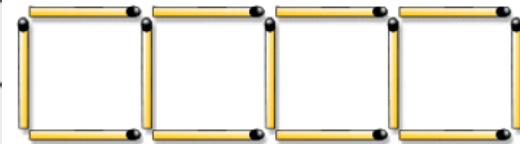
How many matches are needed to get 100 rectangles in a row?

1. ‘Problem’ solving activities, AR, methods provided

Using and exploring the method (14%)

Activity	Problem-solving process (timeline)
Problem solved	
Verifying	
Planning/Implementing	
Exploring	
Analyzing	
Reading	

Practice AR-task, method provided



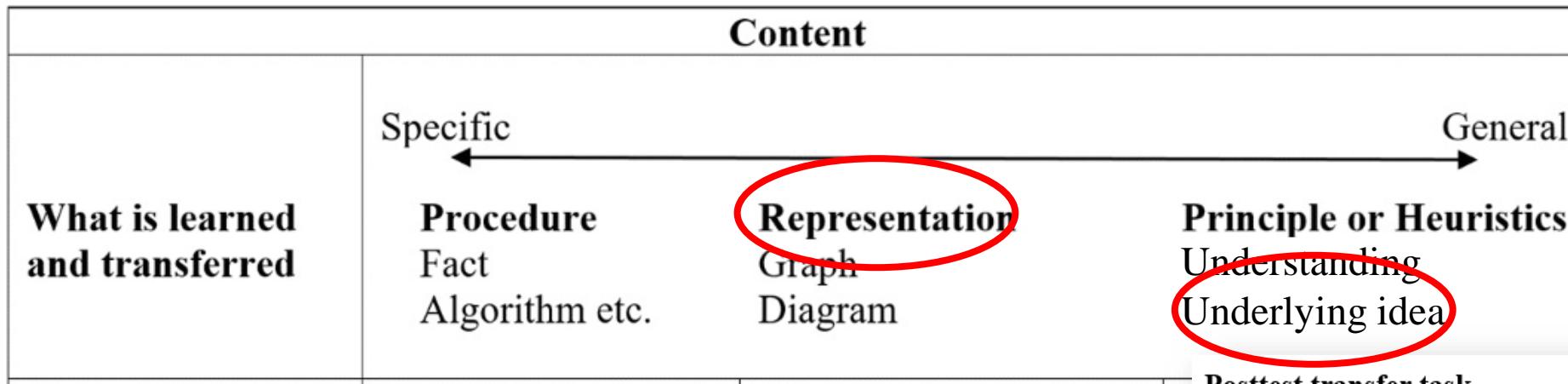
When squares are put in a row, it looks like the figure on the right, 13 matches are needed for four squares.

The number of matches y could be calculated $y = 3x + 1$

Example: If 4 squares > then $y = 3x+1 = 3 \cdot 4 + 1 = 13$ st

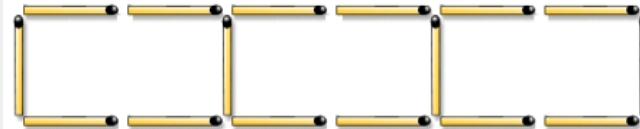
How many matches are needed to get 100 squares in a row?

2. What is transferred from practice to posttest



Transfer: The underlying idea
The formula as representation
Nothing

Posttest transfer task

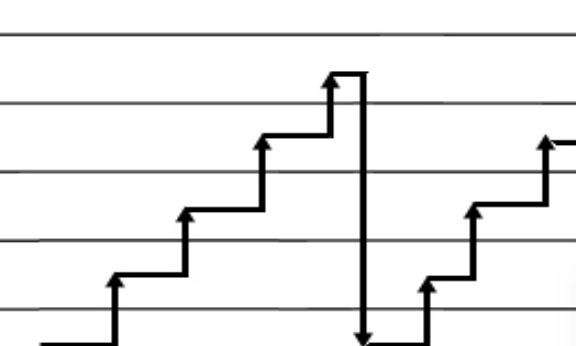


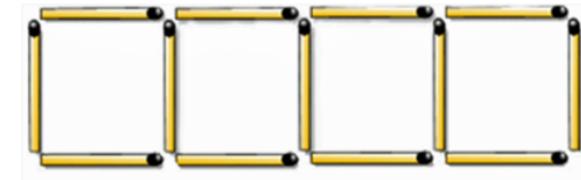
When rectangles are put in a row, it looks like the figure on the right, 16 matches are needed for three rectangles.

How many matches are needed to get 100 rectangles in a row?

1. Problem solving activities, CMR, creating methods

Constructing the Method (52 %)

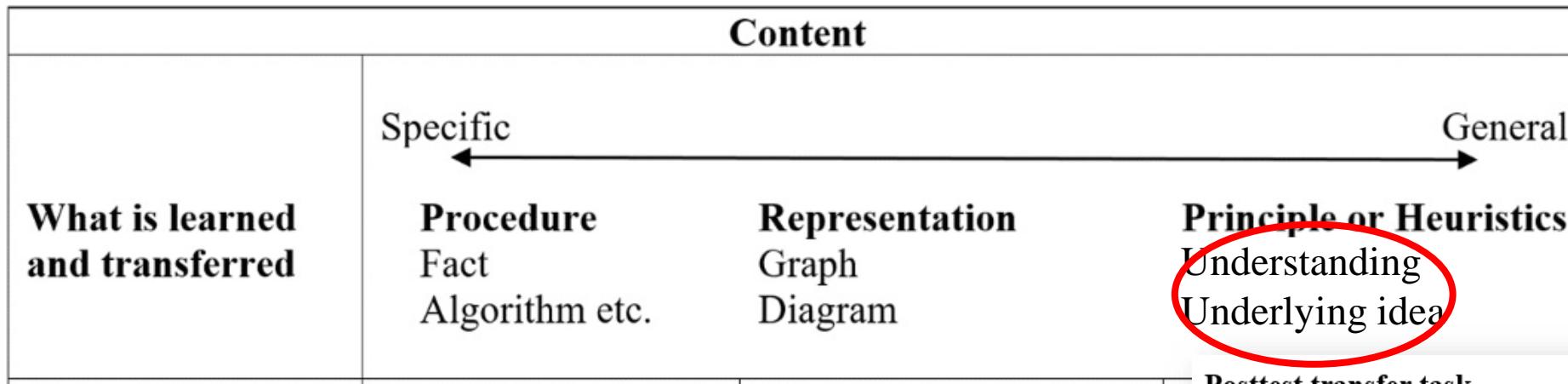
Activity	Problem-solving process (timeline)
Problem solved	
Verifying	
Planning/Implementing	
Exploring	
Analyzing	
Reading	



When squares are put in a row, it looks like the figure;
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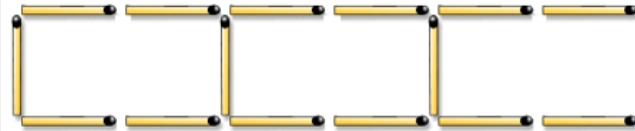
How many matches are needed to get 100 squares in a row?

1. What is transferred from practice to posttest



Transfer: An understanding, an underlying idea
Nothing

Posttest transfer task

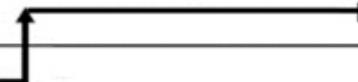


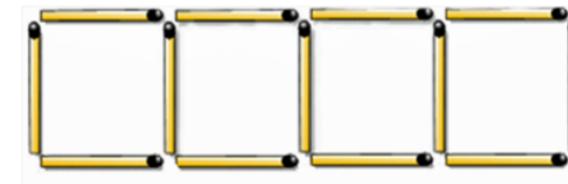
When rectangles are put in a row, it looks like the figure on the right, 16 matches are needed for three rectangles.

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1. Problem solving activities, CMR, creating methods

Failing to construct a method (all together 48%)

Activity	Problem-solving process (timeline)
Problem solved	
Verifying	
Planning/Implementing	
Exploring	
Analyzing	
Reading	



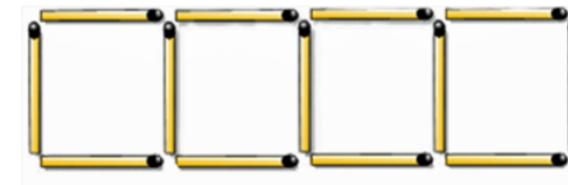
When squares are put in a row, it looks like the figure;
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1. Problem solving activities, CMR, creating methods

Failing to construct a method (all together 48%)

Activity	Problem-solving process (timeline)
Problem solved	
Verifying	
Planning/Implementing	
Exploring	
Analyzing	
Reading	



When squares are put in a row, it looks like the figure;
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How many matches are needed to get 100 squares in a row?

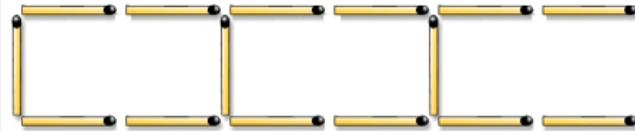
2. What is transferred from practice to posttest

Content			
	Specific		General
What is learned and transferred	Procedure Fact Algorithm etc.	Representation Graph Diagram	Principle or Heuristics Understanding Underlying idea

Transfer: Nothing

Ideas to develop during posttest

Posttest transfer task



When rectangles are put in a row, it looks like the figure on the right,
16 matches are needed for three rectangles.

How many matches are needed to get 100 rectangles in a row?

Questions

1. What kind of problem solving activities are students engaged in?
(Constructing v/s Using Methods)

AR: Hardly no time analysing and exploring

CMR: Substantial time analysing and exploring

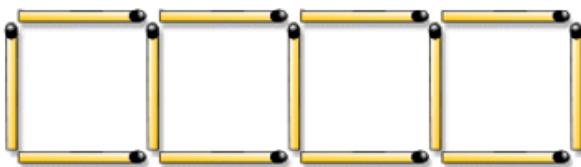
2. What knowledge do students transfer from practice to posttest?
(Constructing v/s Using Methods)

	Practice	Main Transfer to posttest
AR	Using the method (86%)	'Nothing'
	Exploring and using the method (14%)	An understanding of an underlying idea
CMR	Constructing a method (52%)	An understanding of an underlying idea
	Failing to construct a method (48%)	'Nothing'

2.What is transferred from practice to posttest (AR)

AR-practice (60 students x 6 tasks = 360 answers)

Practice AR-task, method provided



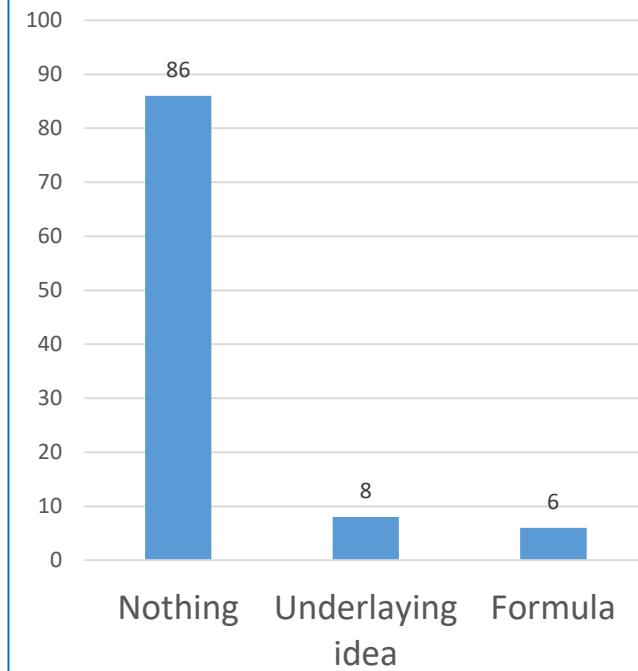
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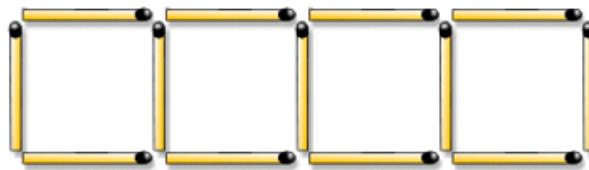
Transfer from practice
to posttest



2. What is transferred from practice to posttest (CMR)

CMR-practice (60 students x 6 tasks = 360 answers)

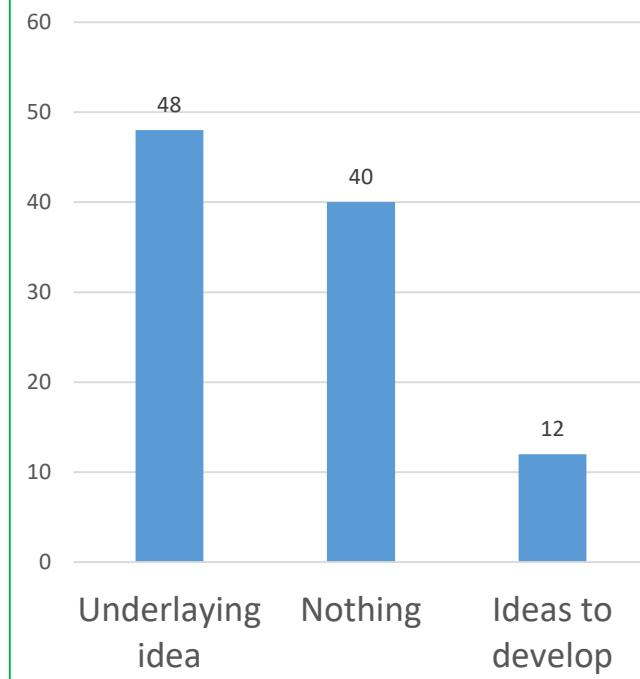
Practice CMR-task, constructing method



When squares are put in a row, it looks like the figure on the right,
13 matches are needed for four squares.

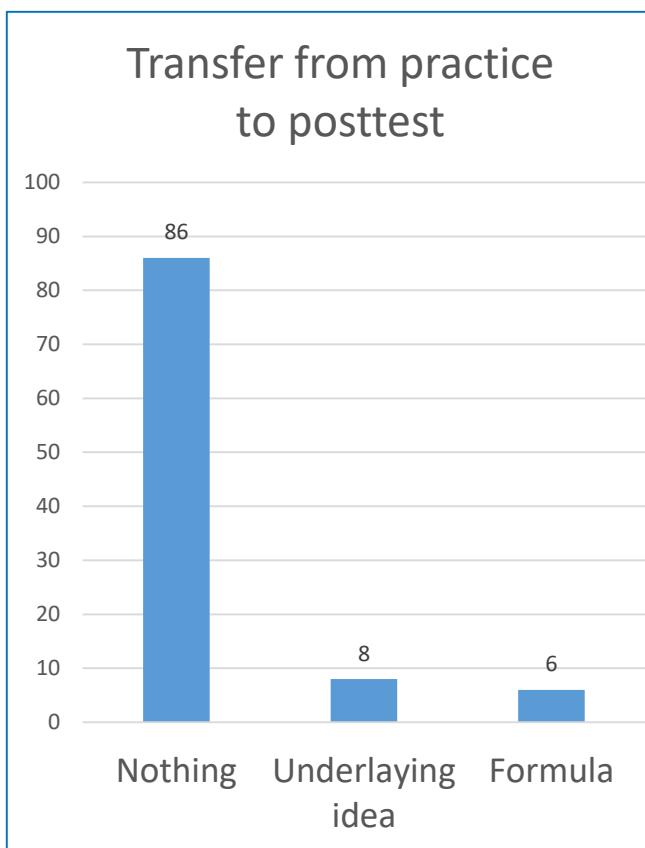
How many matches are needed to get 100 squares in a row?

Transfer from practice
to posttest

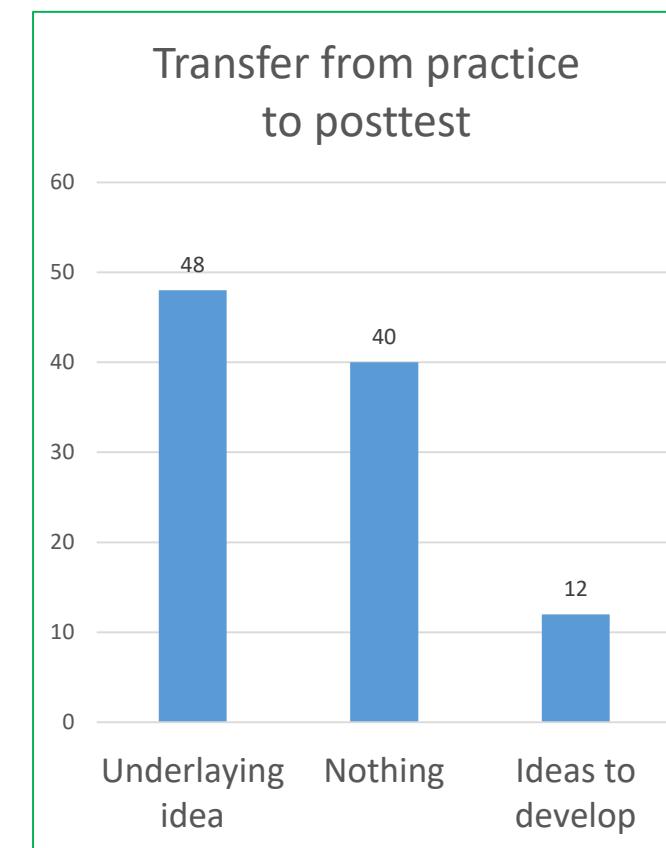


2. What is transferred from practice to posttest (AR/CMR)

AR-practice (360 answers)



CMR-practice (360 answers)





Questions?