FaSMEd

The University of Nottingham

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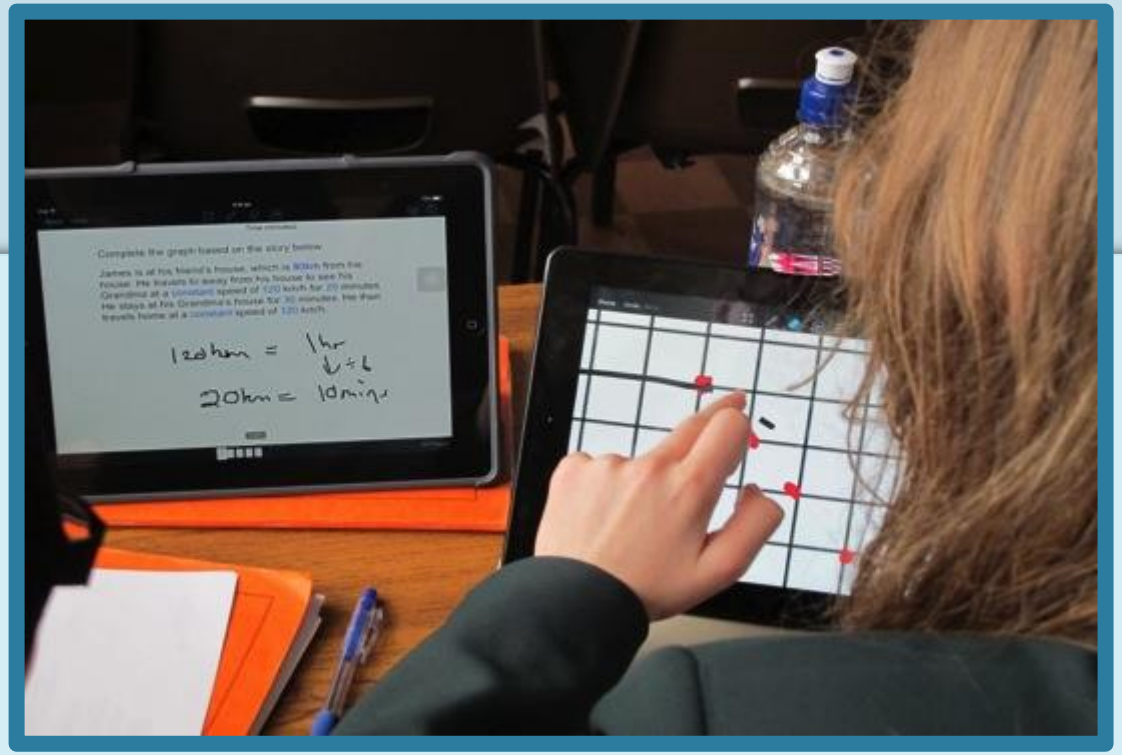



# University of Nottingham
# Lyon, April 2015

# Research focus

The research focuses on the **use of iPads** in mathematics lessons and how they can be used to facilitate or enhance formative assessment.

The lessons in this phase all involved some **paired work** using iPads (or laptops) but with different software and mathematical topics.

# Formative assessment

What is the impact from using the technology when:

- Building on student's prior knowledge;
- Identifying and responding to students' conceptual difficulties;
- Using questioning;
- Increasing student collaboration;
- Enabling students to become assessors.

# Research questions (1)

- How do teachers **process** formative assessment data from students using a range of technologies?
- How do teachers **inform their future teaching** using such data?

# Research questions (2)

- How is formative assessment data used by students **to inform their learning trajectories**?

- When technology is positioned as a learning tool rather than a data logger for the teacher, **what issues does this pose for the teacher** in terms of their being able become more informed about student understanding?

# The research plan

The research involves:

- **Three schools** and three teachers in each school;
- **Three lessons** in each school, to be developed and taught by each teacher;
- Observation or video-recording of each lesson in **three phases**: March, May and June 2015.

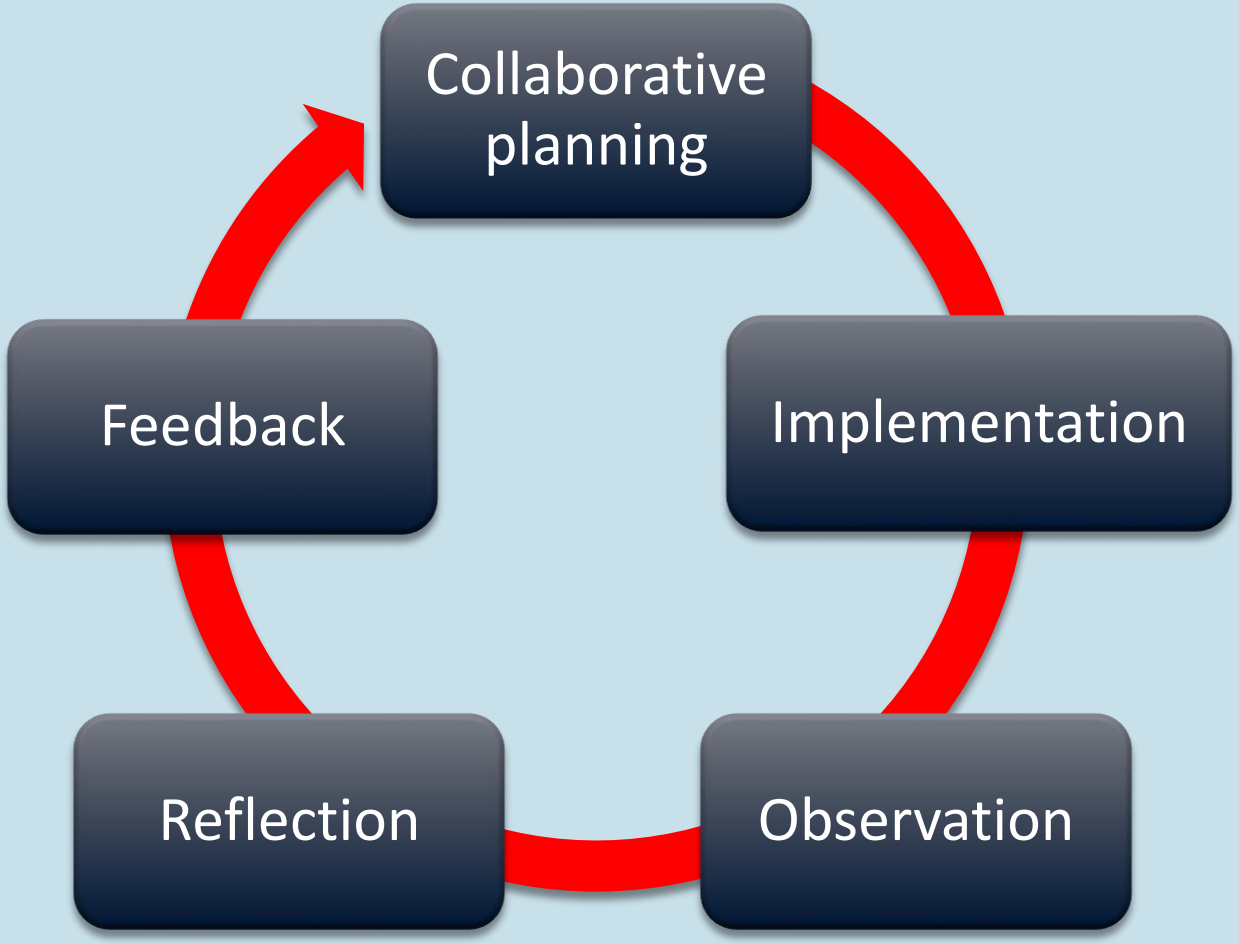
# The schools

**Trinity Catholic School** in the city of Nottingham for pupils aged 11-18 years.

**De Ferrers Academy** in the town of Burton-on-Trent for pupils aged 11-18 years.

**Bagthorpe Primary School** in the village of Bagthorpe is a school for pupils aged 5-11 years.

# The planning cycle



# Questions for teachers

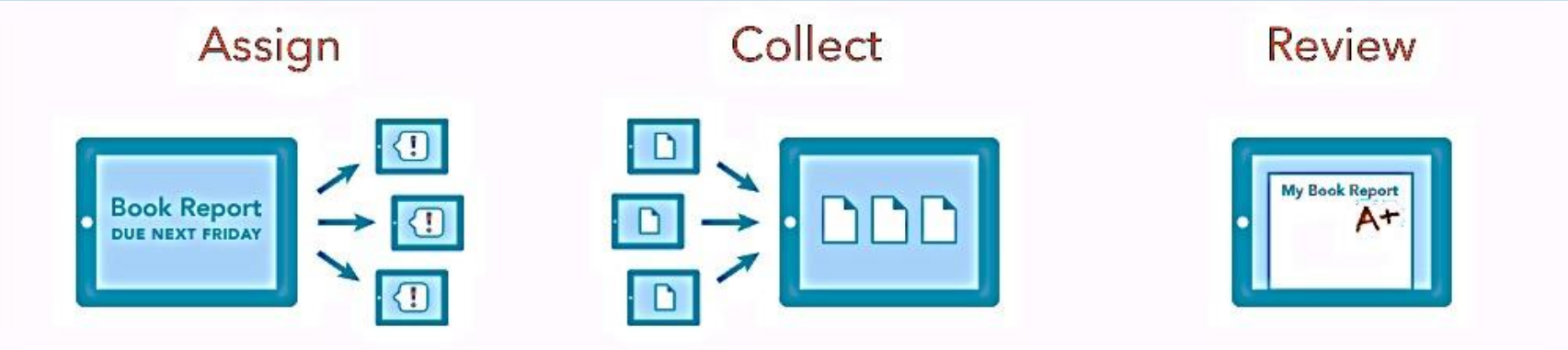
- What did you do?
- How was the technology used?
- What were the opportunities for formative assessment?
- How were the opportunities used?
- What have you learned?

# Framework for analysis of lesson observations

| |
|---|
| **Whole class introduction** |
| Whole class interventions and questioning |
| Drawing together students' ideas |
| Student engagement with whole-class discussion |
| **Return of student work** |
| Providing formative feedback |
| Student responses to formative feedback |
| **Individual working time** |
| Monitoring and assisting individual students |
| Student interaction with teacher during individual work |
| **Collaborative work** |
| Fostering peer assessment and questioning |
| Monitoring and assisting individual students |
| Student interaction with teacher during group work |
| Student interaction with peers during group work |
| **Students' evaluation of student work** |
| Assessing samples of written student work |
| Student interaction with teacher during group work |
| Student interaction with peers during group work |

# Lesson 1: distance-time graphs

- Two diagnostic questions to start the lesson;
- Use of *Showbie* to:

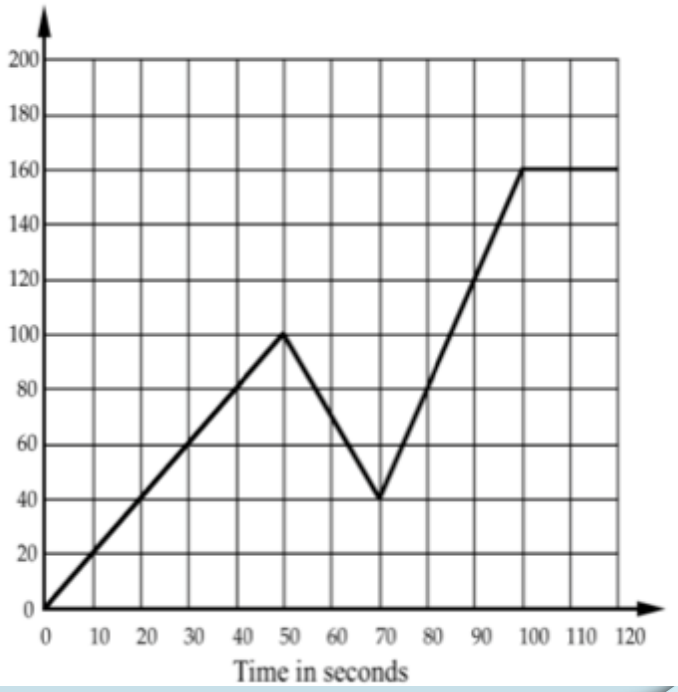



- Selected student work used to discuss and address misconceptions;
- Peer assessment and discussion based on responses to ‘mirrored’ questions.

# Interpreting a graph

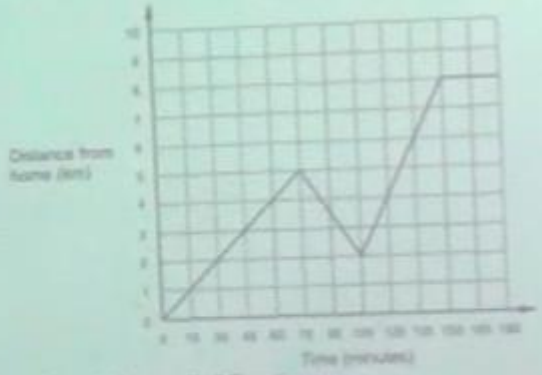
## A walk to the shop...

One day John went for a walk to the shop. The graph shows his walk. Describe what may have happened.



A walk to the shop...

One day John went for a walk to the shop. The graph below shows his walk. Describe what may have happened.




It took him 1 hour & 15 minutes to walk 5 km. Then he went back 3 km which took him 30 minutes. Then he walked 6km in 1 hour & 15 minutes. He then stopped at 8km for 30 minutes

# Drawing a graph

## A long drive home

Sarah left her friend's house at 5pm. Her drive home was expected to be 140km. She travelled at a constant speed of 80km/h for 30 minutes. She was then stuck in a stationary traffic jam for 10 minutes. The traffic then began moving at a constant speed of 60km/h for 20 minutes. Finally, the traffic cleared and she completed her journey home at a constant speed of 120km/h.

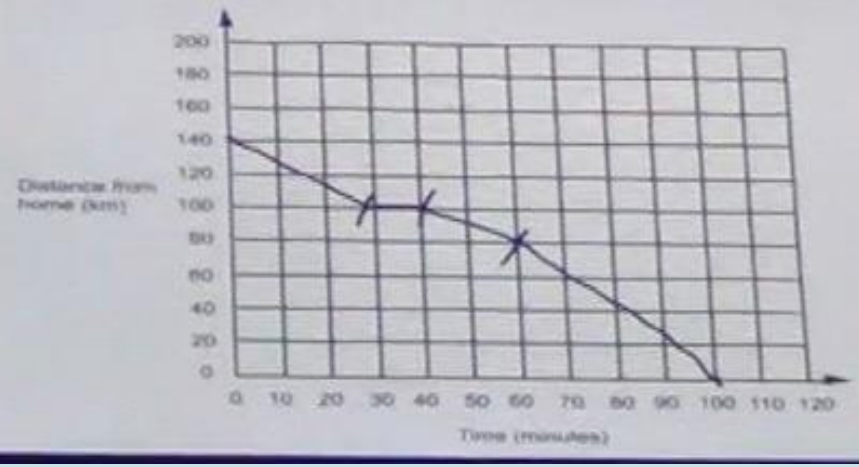
Complete the graph for Sarah's journey.

# Making decisions

# Completing the graph

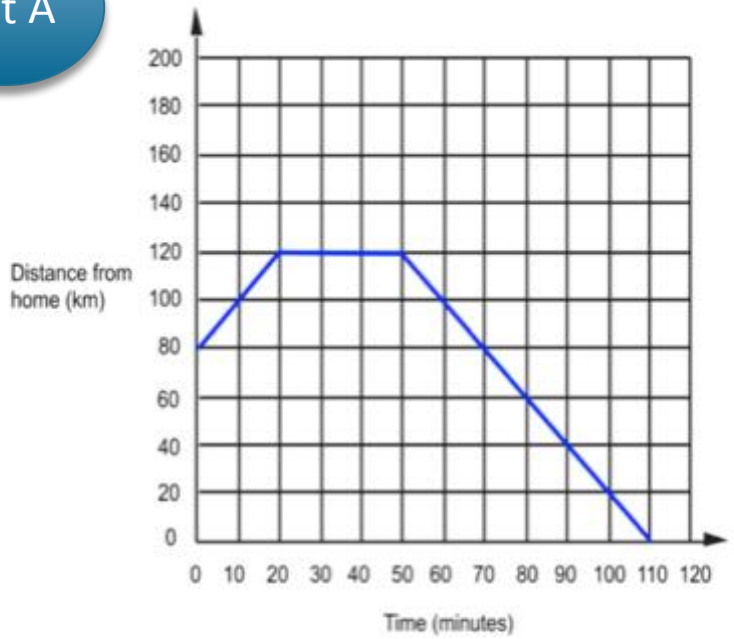
Sarah left her friend's house at 5pm. Her drive home was expected to be 140km. She travelled at a constant speed of 80km/h for 30 minutes. She was then stuck in a stationary traffic jam for 10 minutes. The traffic then began moving at a constant speed of 60km/h for 20 minutes. Finally, the traffic cleared and she completed her journey home at a constant speed of 120km/h.

Complete the graph for Sarah's journey



# Mirrored questions:
## Graph to story; Story to graph

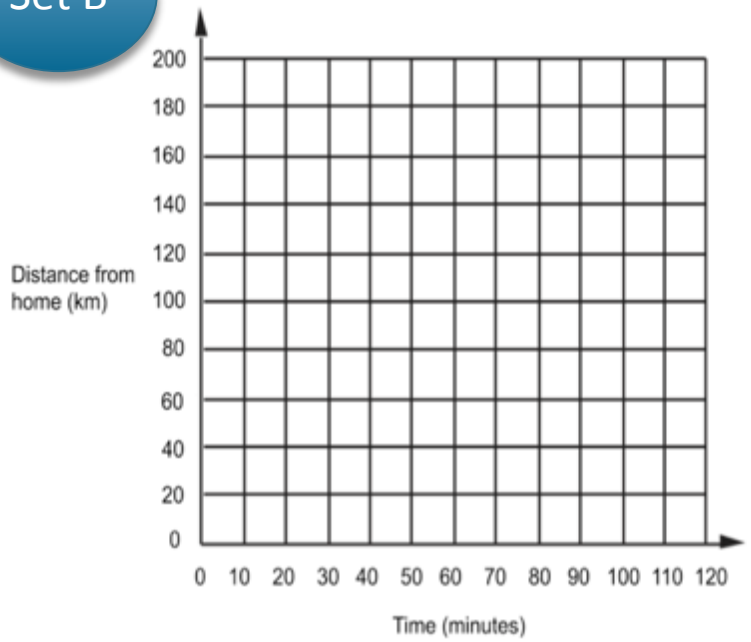
Set A




Complete the story below from the graph.

James is at his friend's house, which is _____ from his house. He travels away from his house to see his Grandma at a _____ speed of _____ km/h for _____ minutes. He stays at his Grandma's house for _____ minutes. He then travels home at a _____ speed of _____ km/h.

Set B




Complete the graph based on the story below.

James is at his friend's house, which is 80km from his house. He travels to away from his house to see his Grandma at a constant speed of 120 km/h for 20 minutes. He stays at his Grandma's house for 30 minutes. He then travels home at a constant speed of 120 km/h.

# Peer assessment and discussion

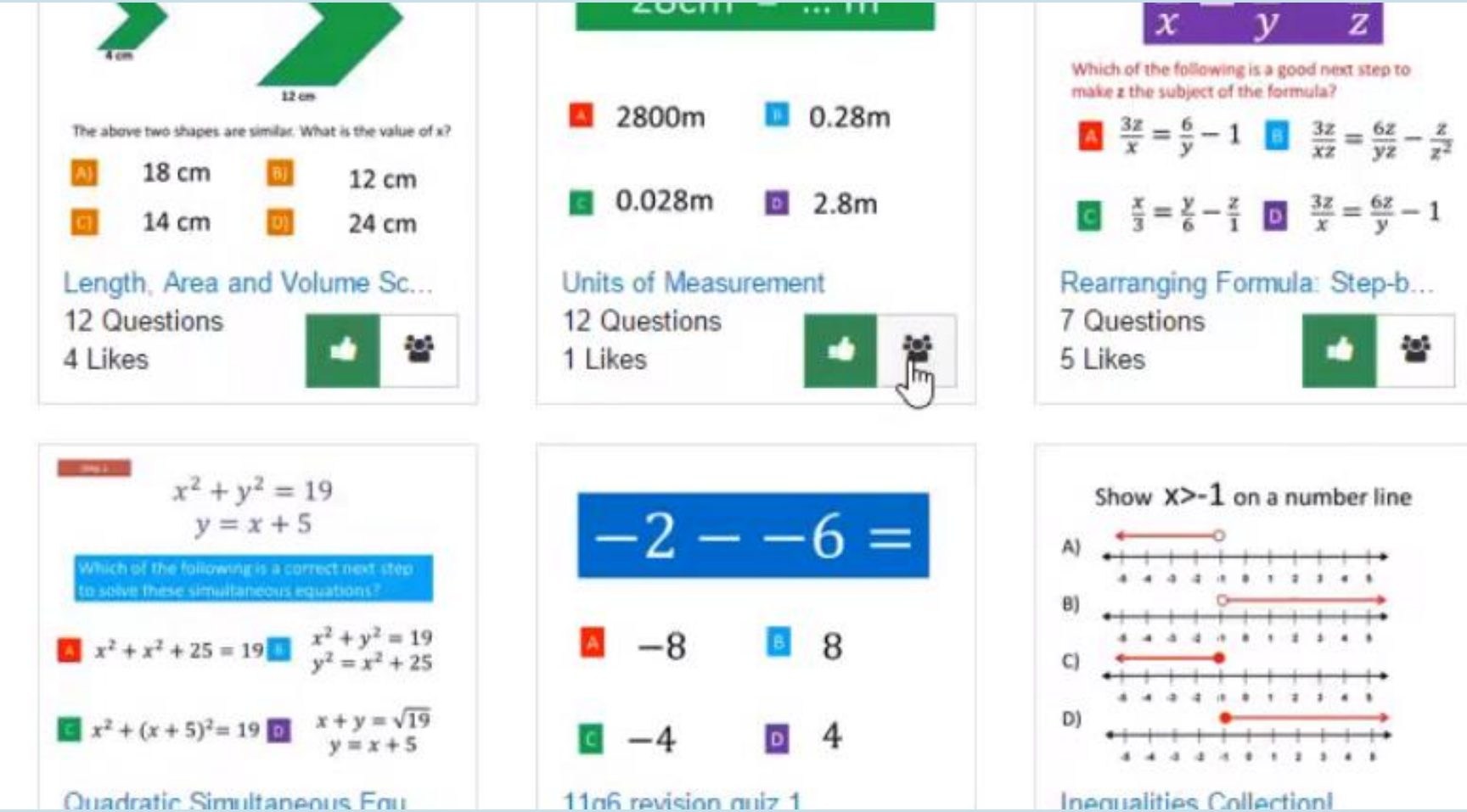
# Lesson 2: algebraic expressions

- Diagnostic assessment prior to lesson using *diagnosticquestions.com*;
- Lesson plan adapted in response to the profile of student responses and reasons given;
- Use of *Nearpod* to send, receive and display selected student responses;
- Selected student work used to discuss and address misconceptions.

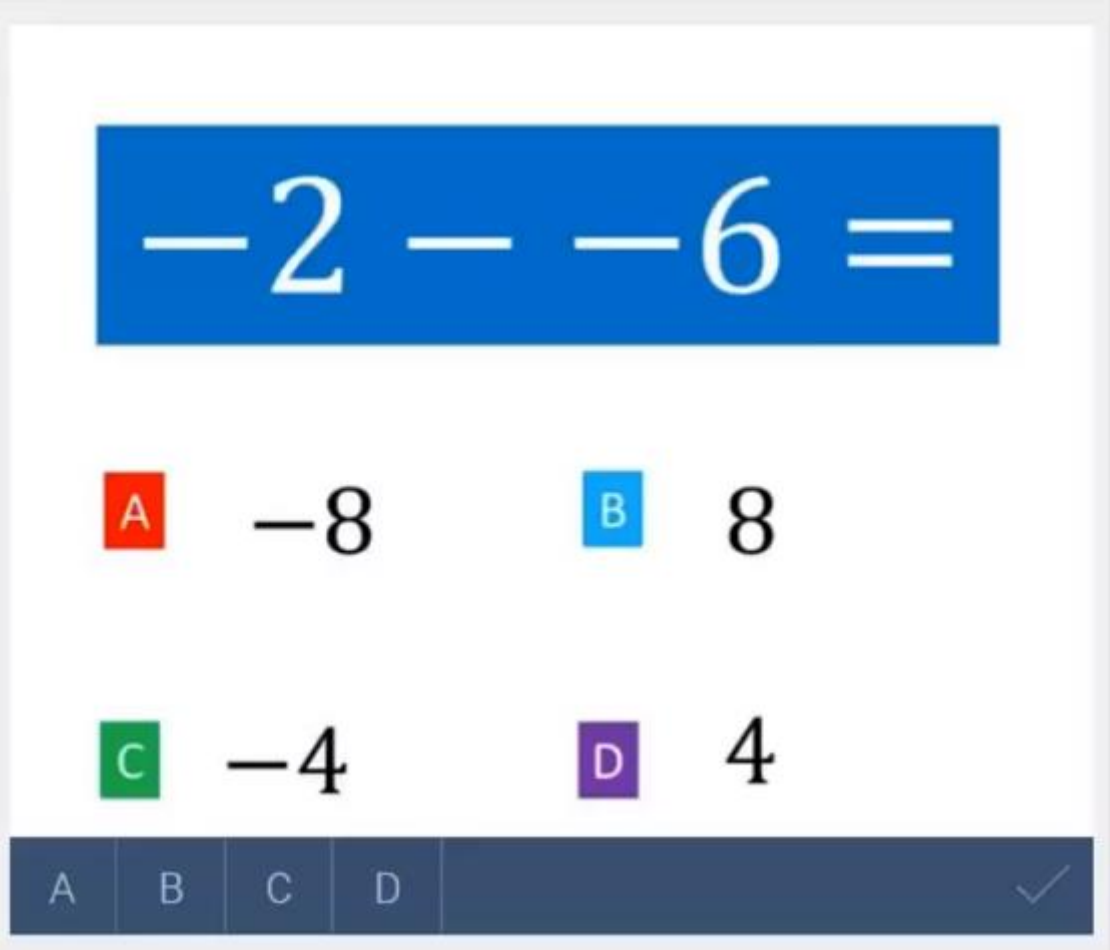
# Pre-lesson diagnostic questions

https://www.diagnosticquestions.com

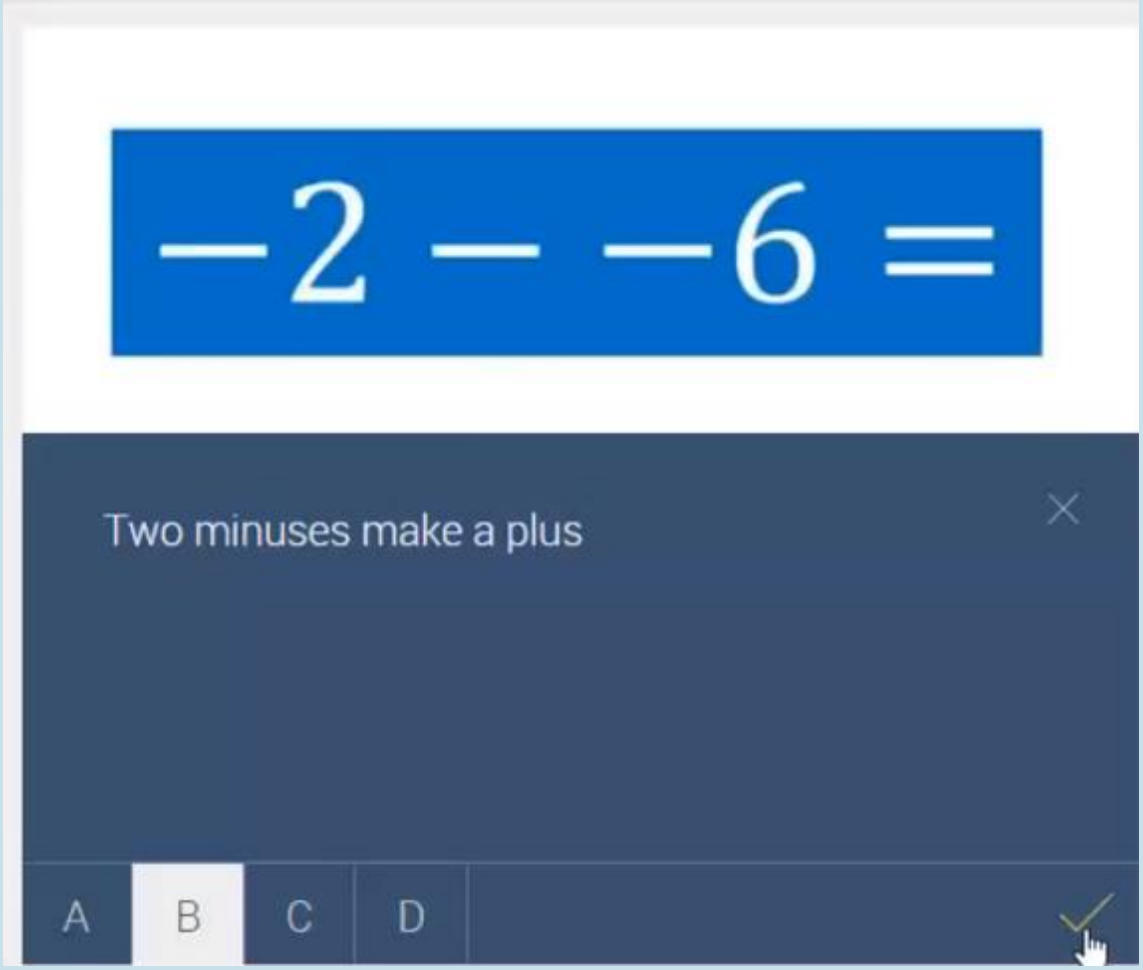
# Questions devised by teachers



# Choices for students



# Student responses



# Options for students

# Teacher overview

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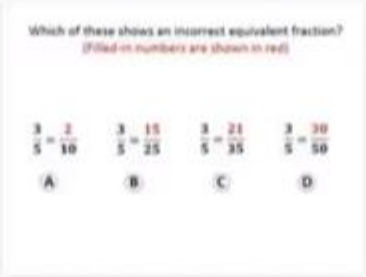
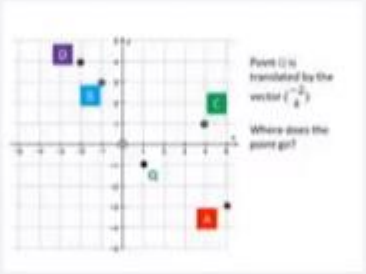
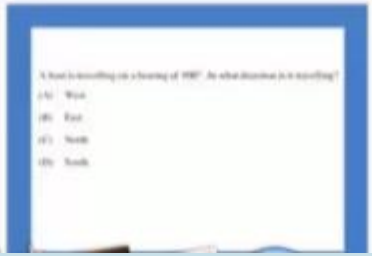
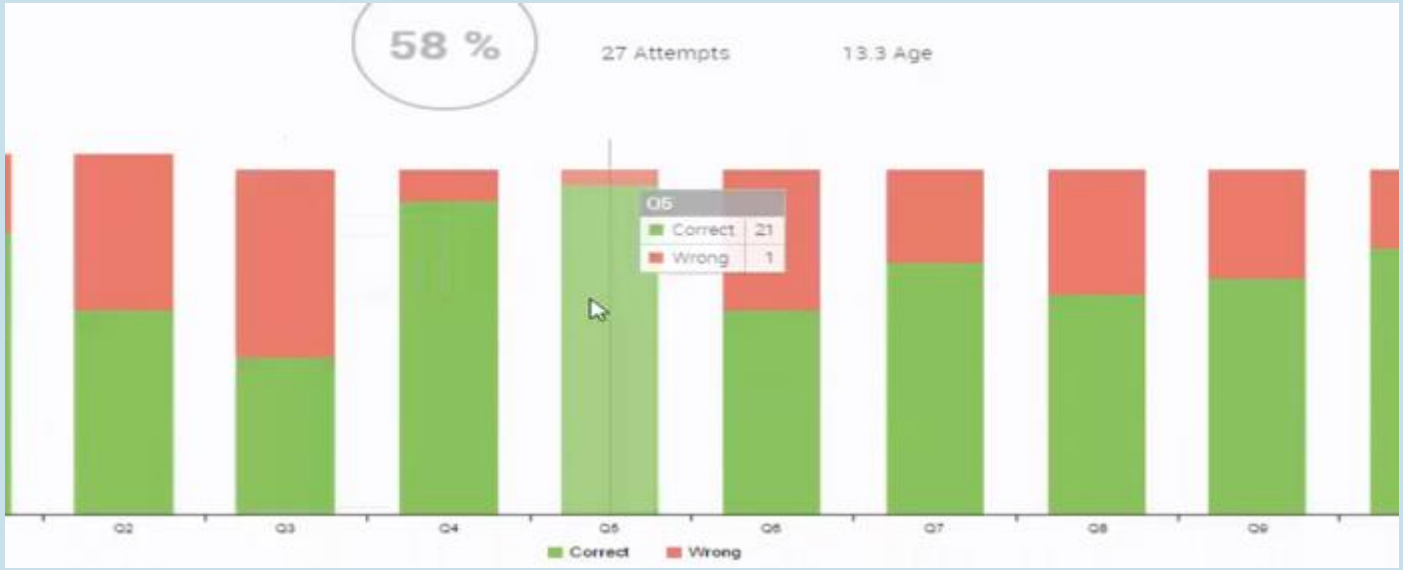
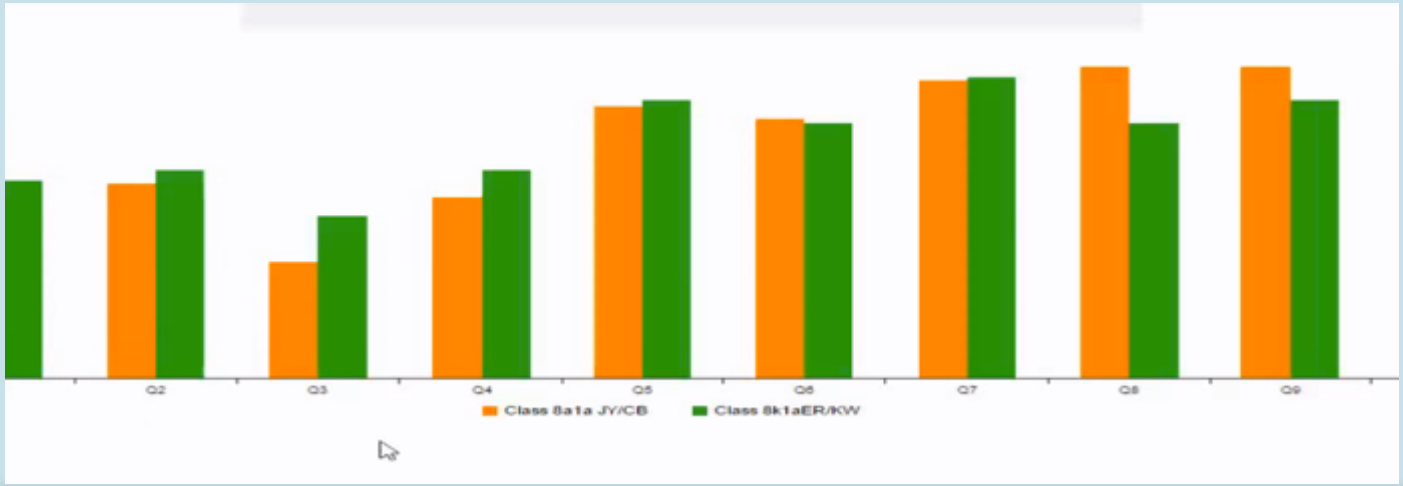
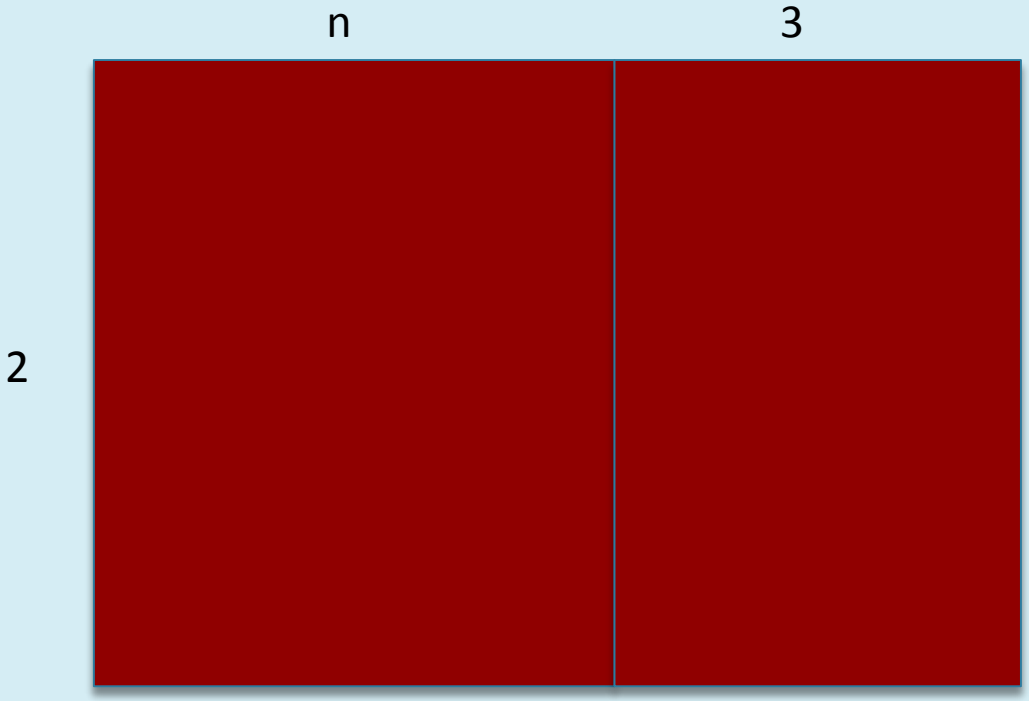
| 5 |   | | | | | 22 | Try Again \| View Explanations |
| 6 |   | | Charlotte Cleary - It goes two left (-2) and 4 up (4) and it gets to point b. | | | 22 | Try Again \| View Explanations |
| 7 |  | | | | | 22 | Try Again \| View Explanations |

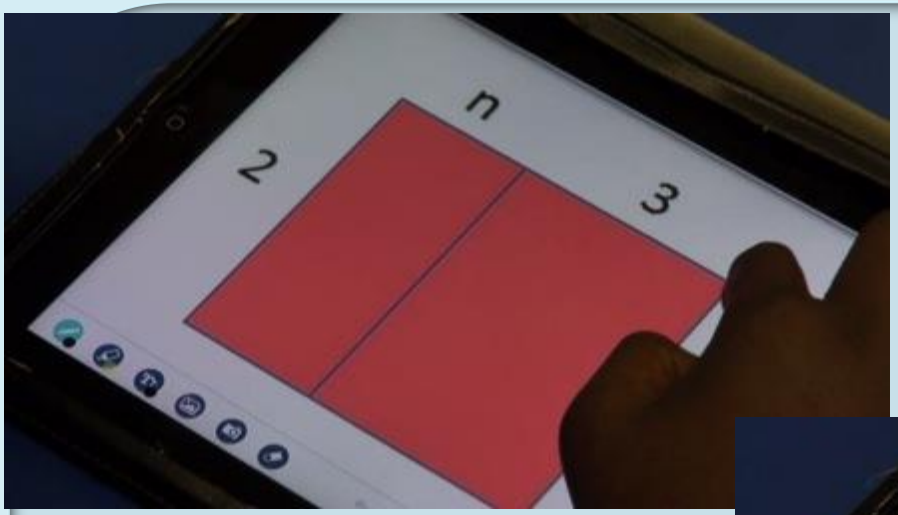
# Class profiles



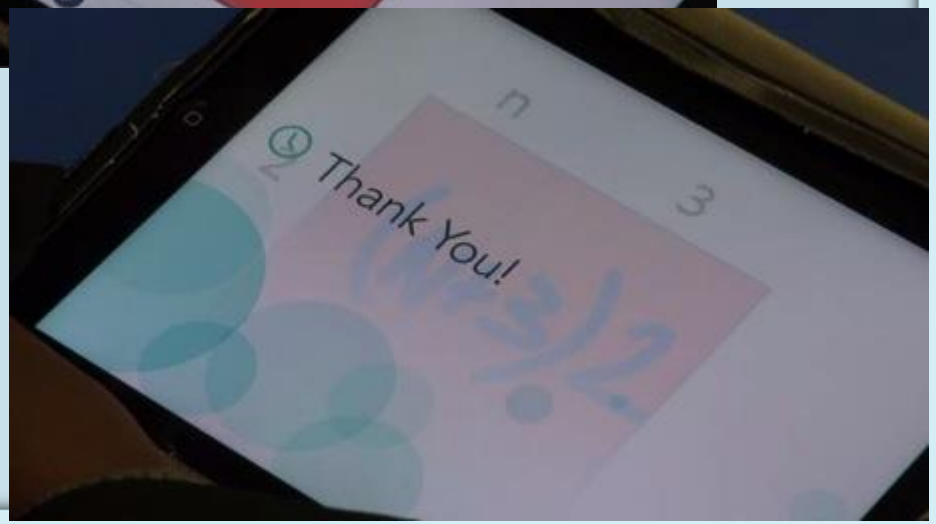
# Write down an expression for the area of the rectangle





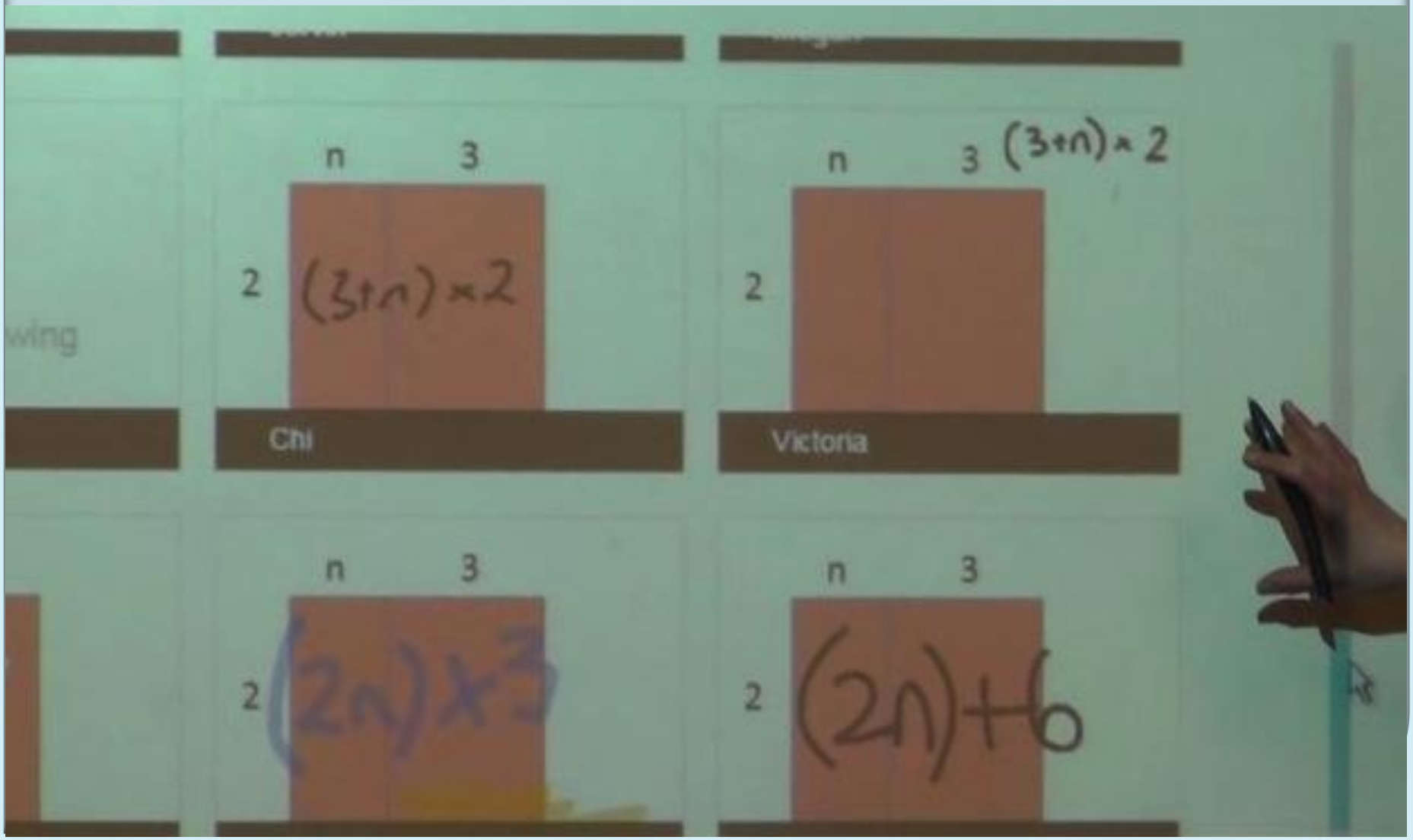

Receiving questions


Working out answers



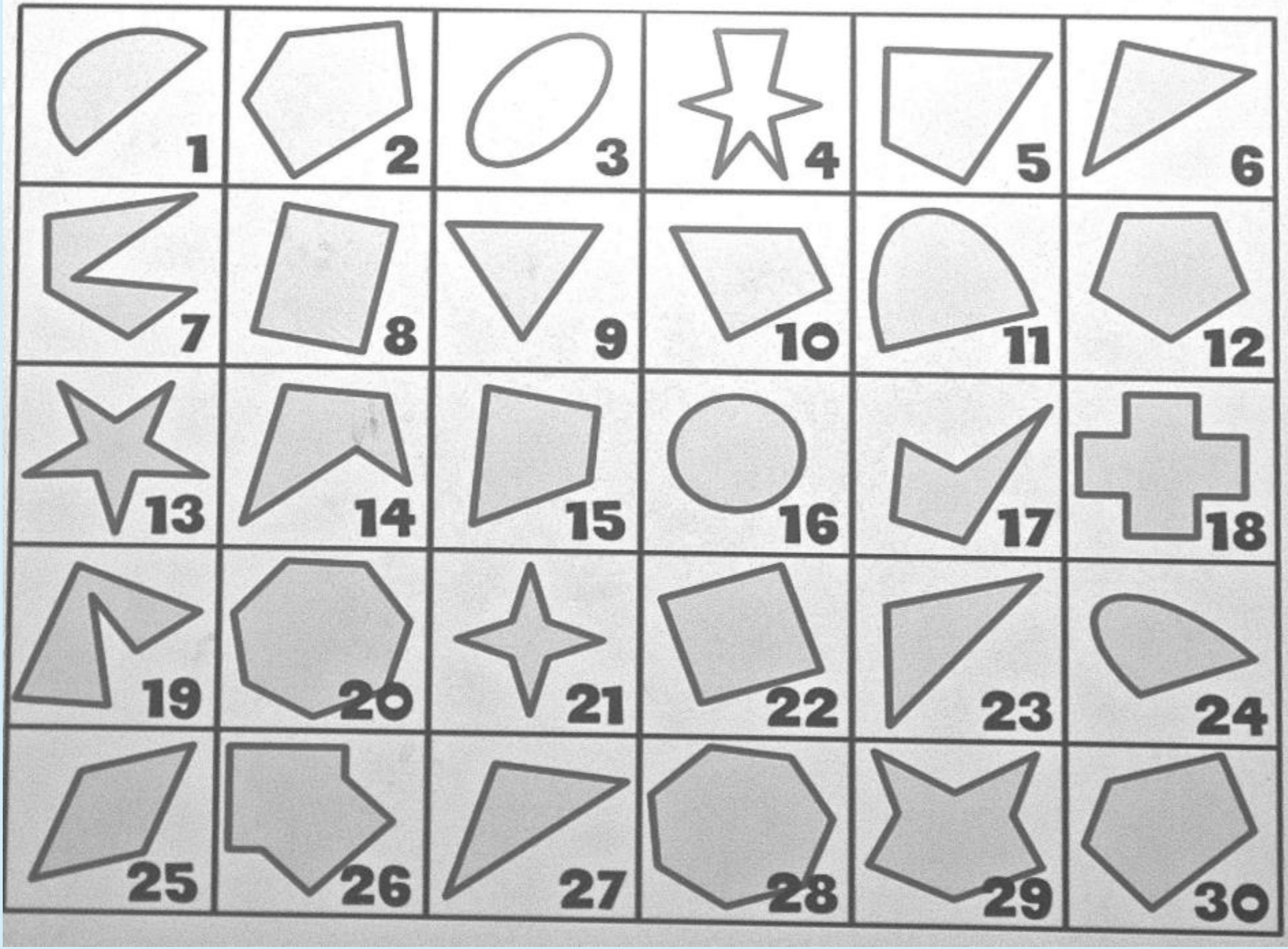

Sending responses

# Class discussion



# Lesson 3: Tessellation

- Students discuss common shapes and their properties with the teacher;
- Students make predictions of shapes that will tessellate;
- Students use the “Tessellation creator” app to test their predictions;
- Students explore tessellations of two or more shapes;
- Students view, assess and comment on work by their peers.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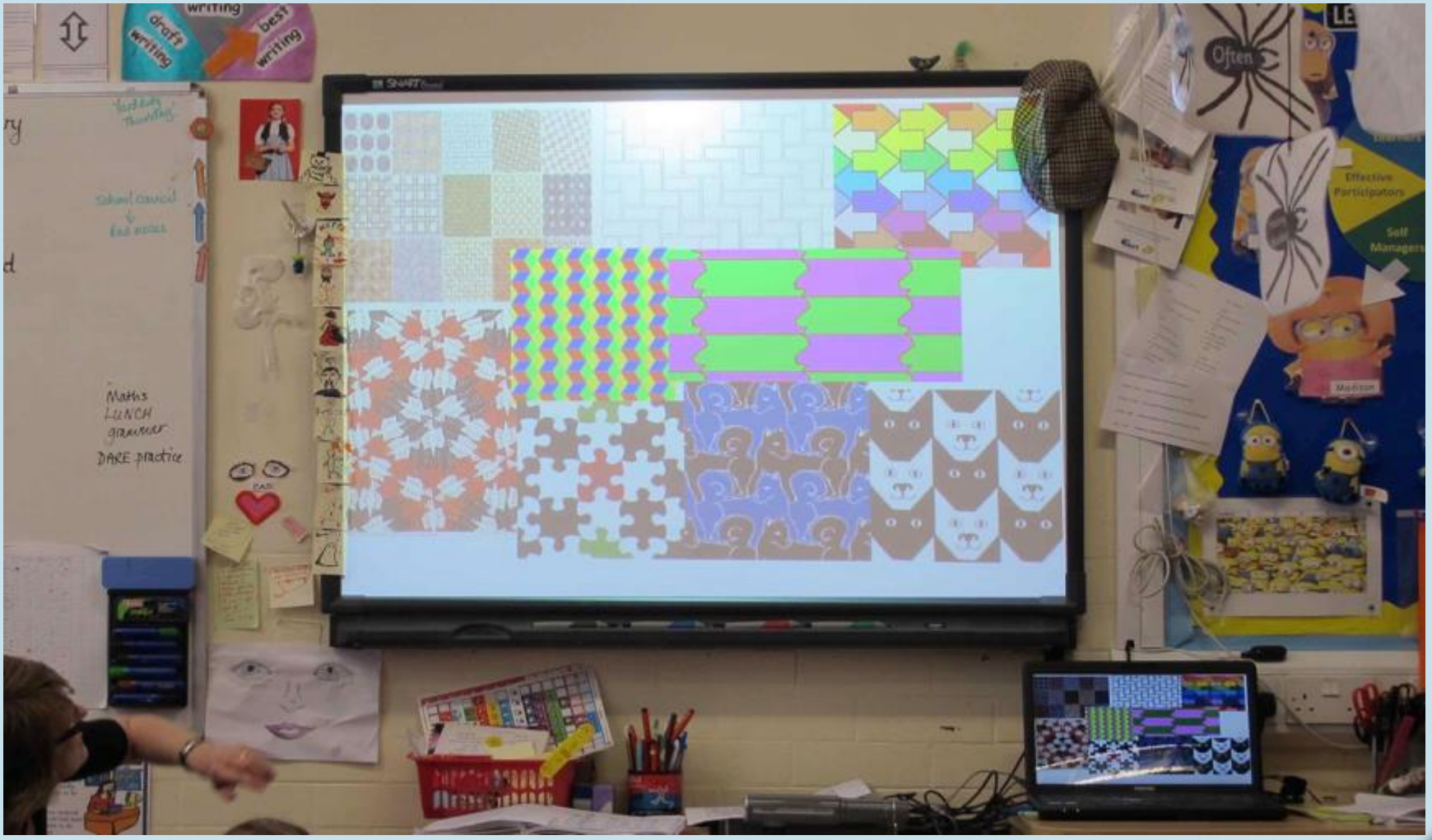
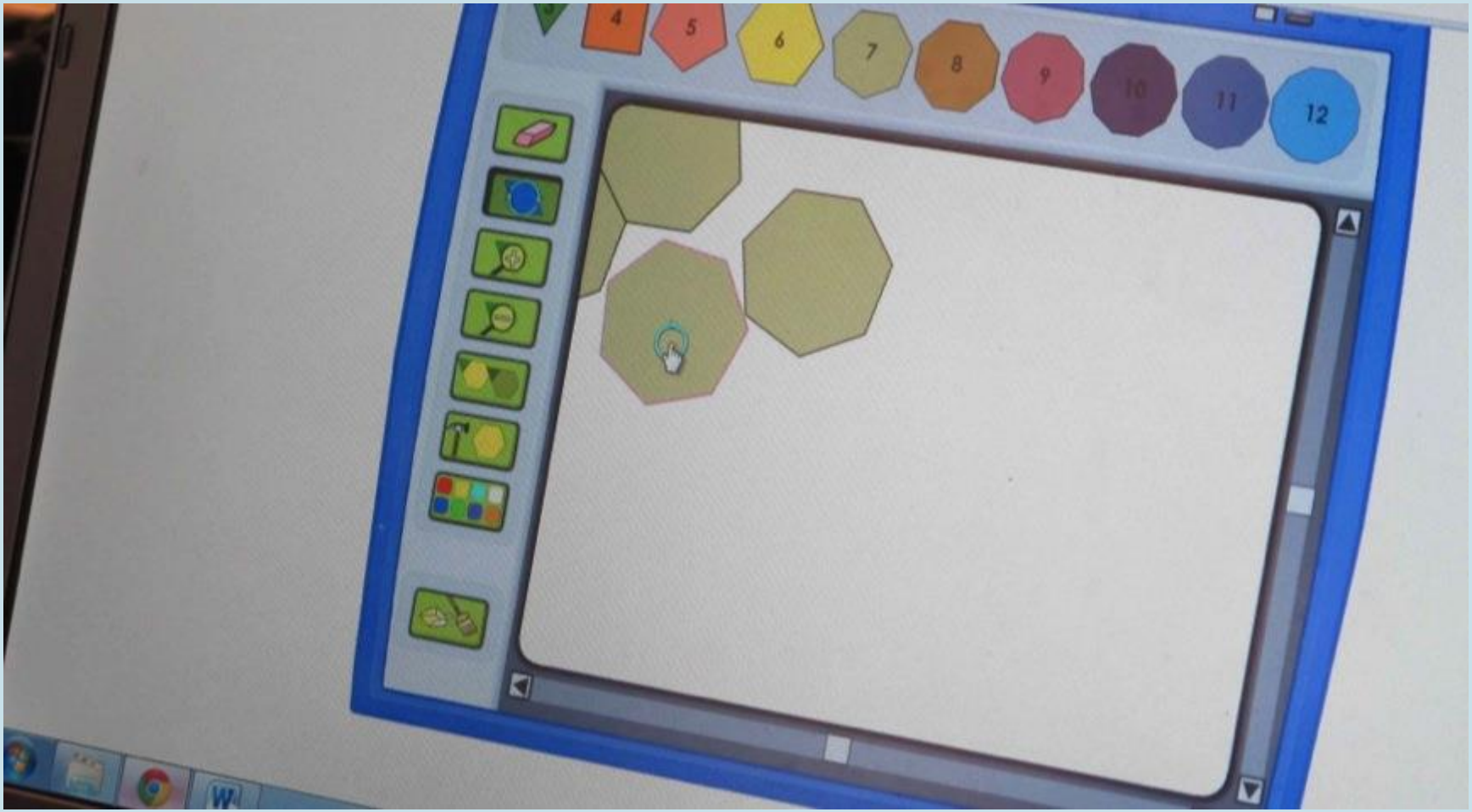
# Discussing tessellation

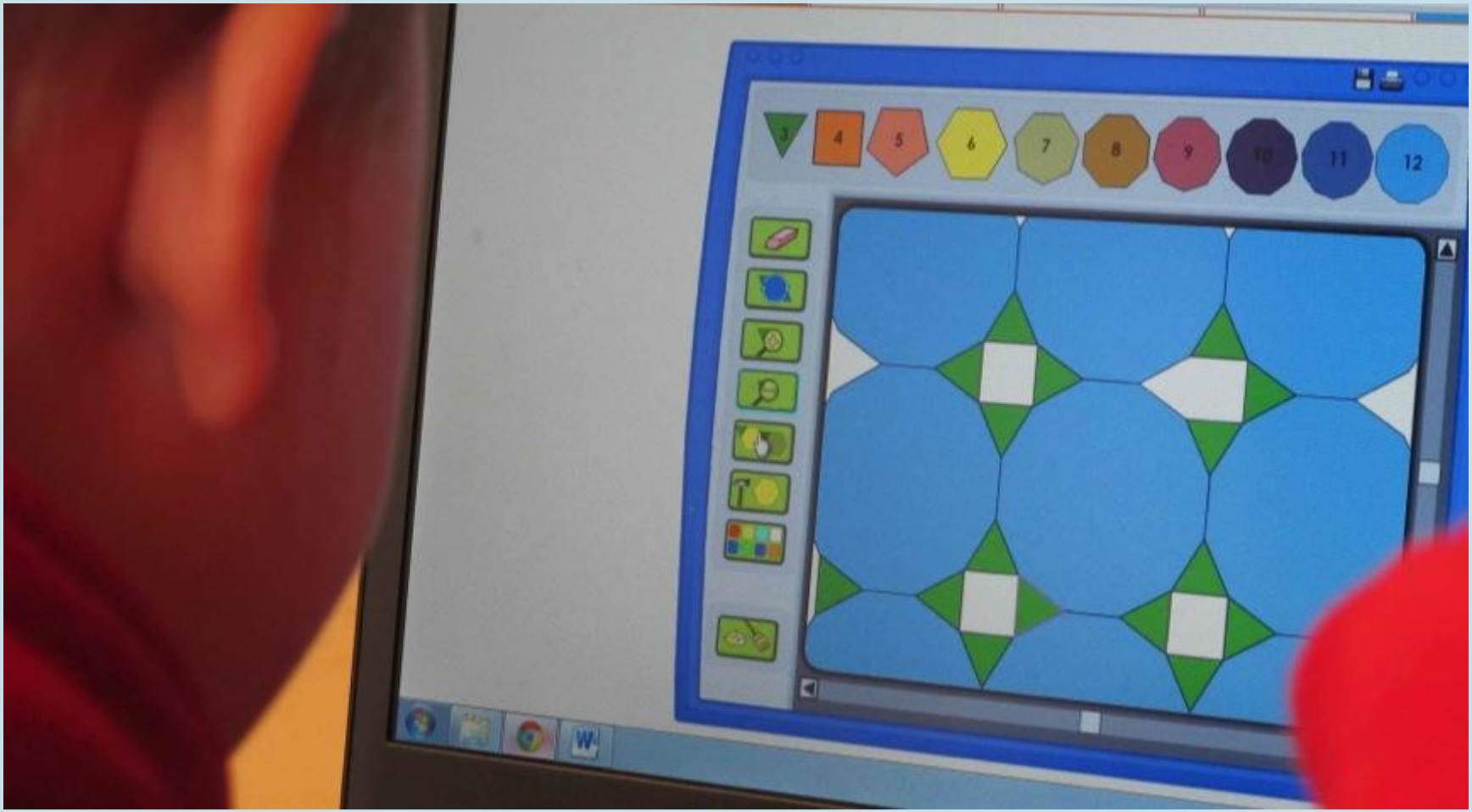


# Making predictions

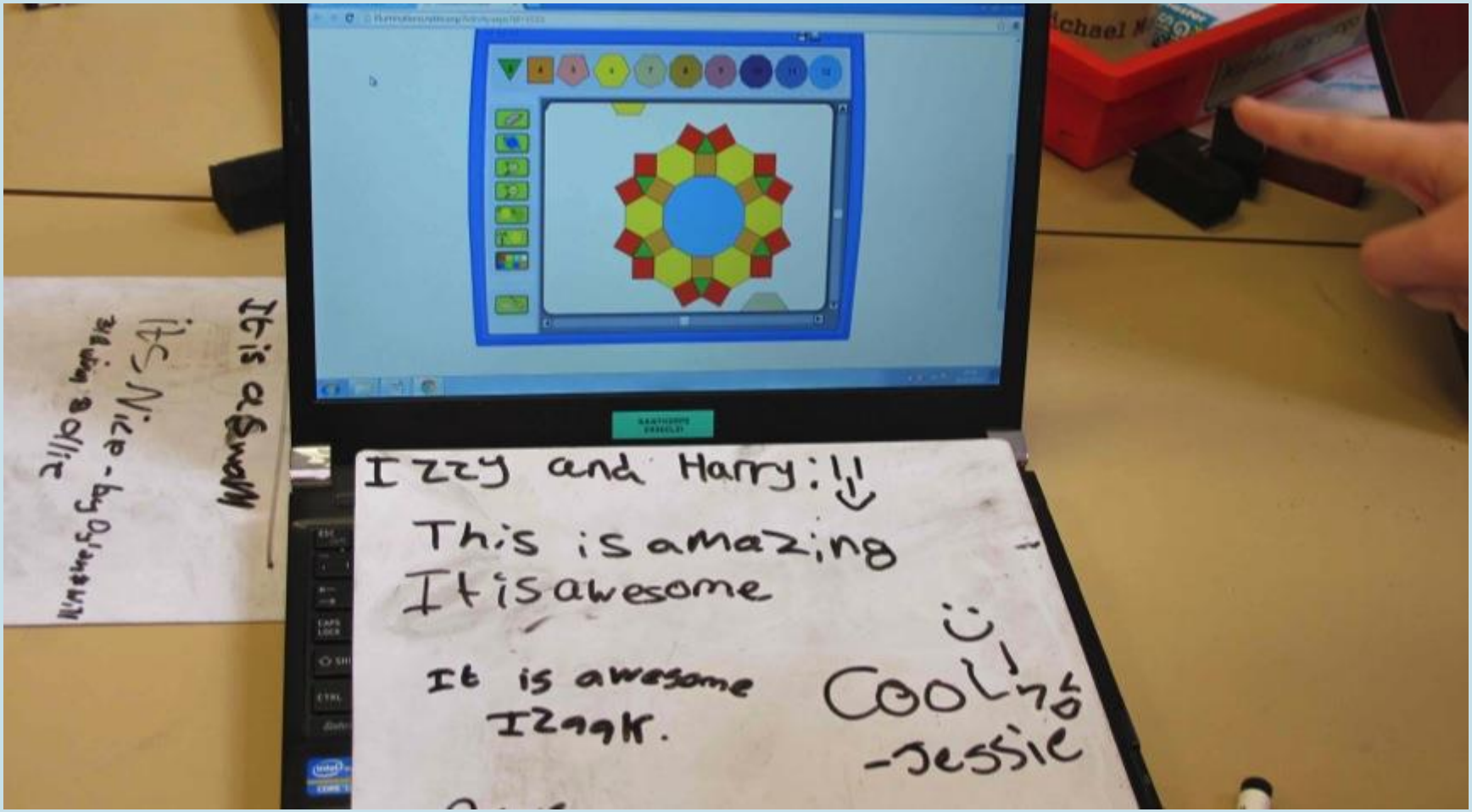
# Testing the predictions



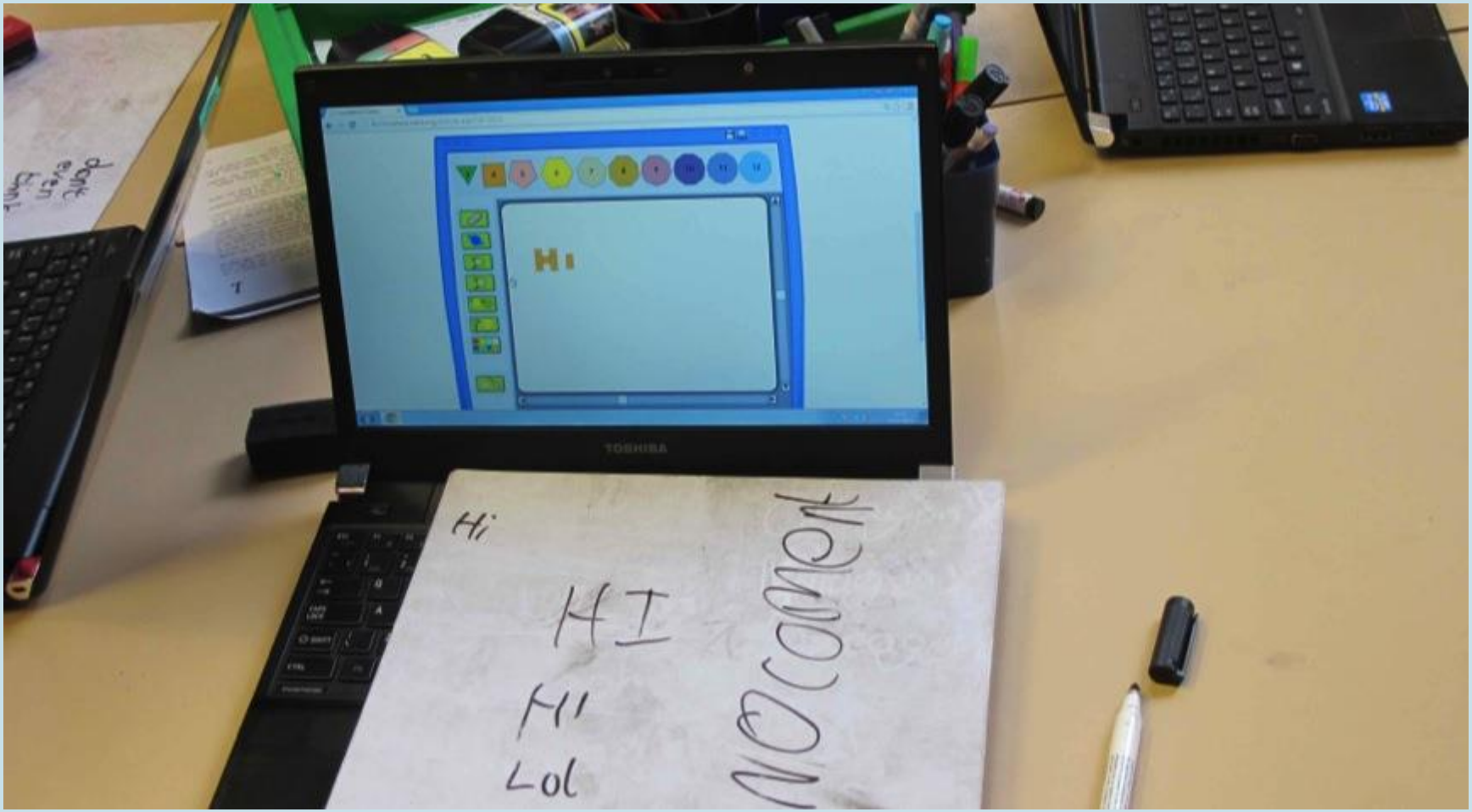
# Exploring further



# Peer assessment

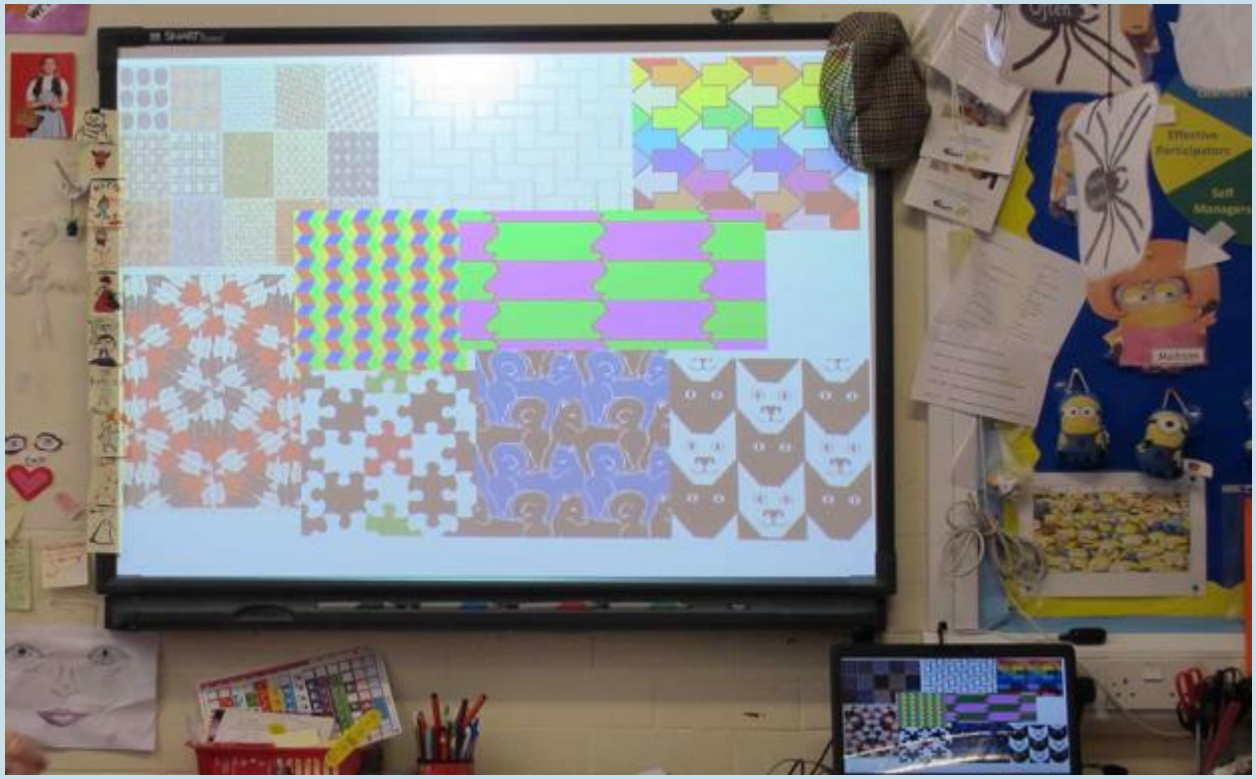


# The limitations of technology?



# The role of technology (1)

A direct replacement for paper-based methods of formative assessment?

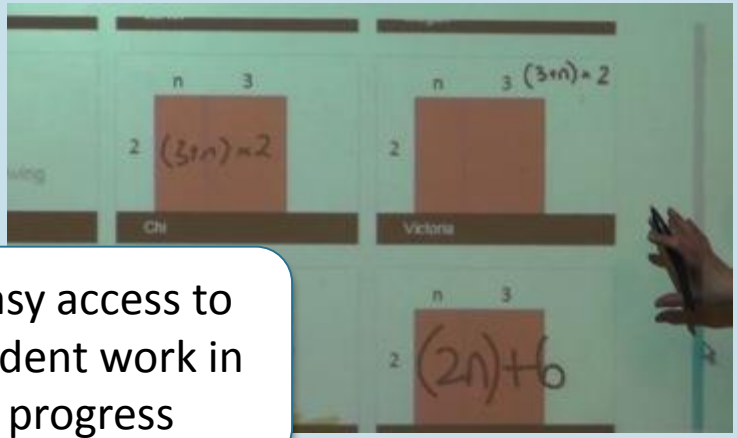


# The role of technology (2)

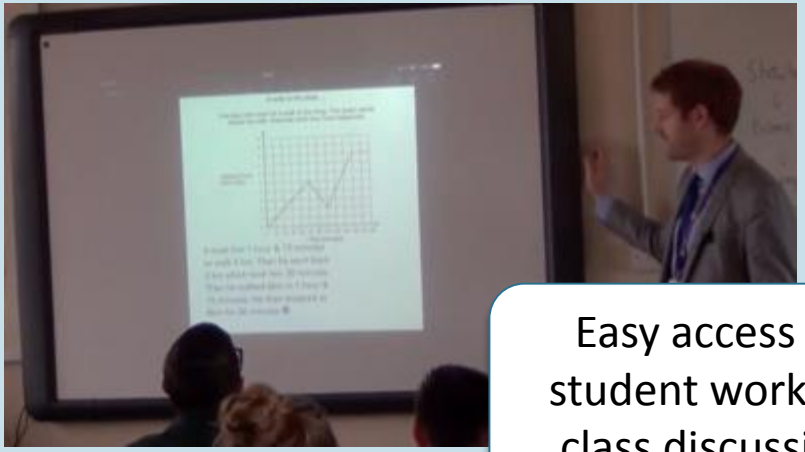
A replacement with the same function but additional benefits?


Ease and speed of obtaining class profiles

Less time drawing so more time for student discussion



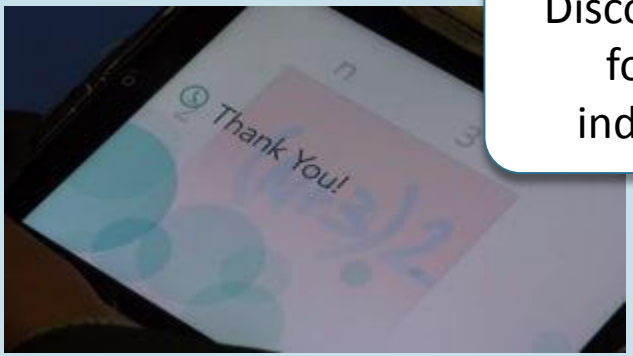

Easy access to student work in progress



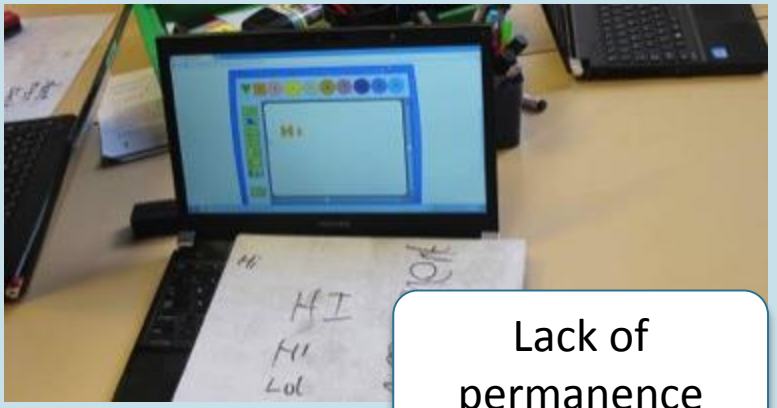
Easy access to student work for class discussion

# The role of technology (3)

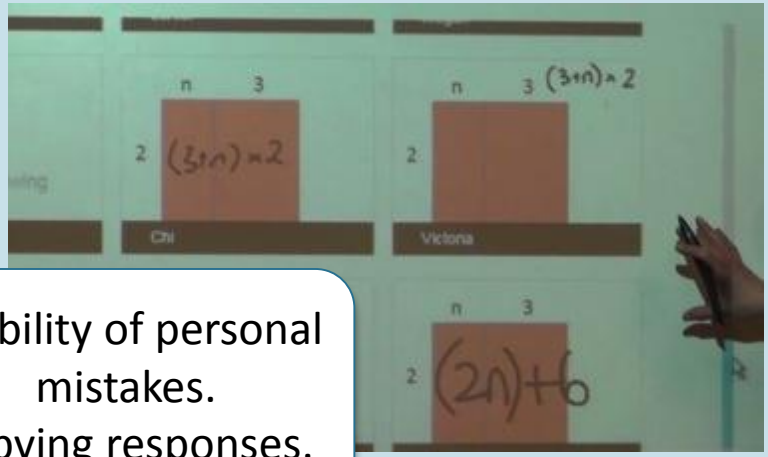
A replacement with the same function but some disadvantages?



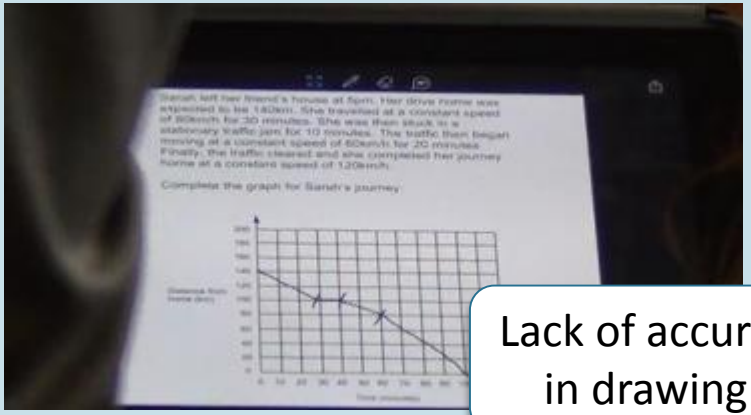

Discontinuity for the individual



Lack of permanence




Visibility of personal mistakes.
Copying responses.

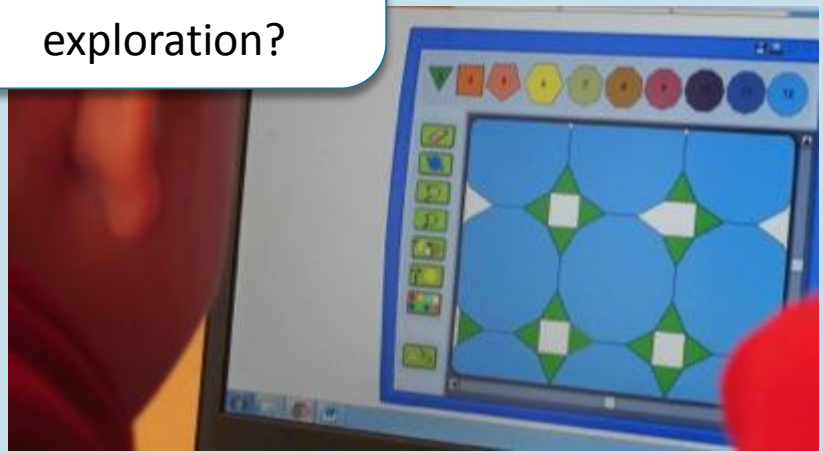


Lack of accuracy in drawing

# The role of technology (4)

A tool that significantly changes the process of formative assessment?

Presenting new questions and areas for exploration?



Changing the nature of peer assessment and discussion?

| |
|---|
| **Whole class introduction** |
| Whole class interventions and questioning |
| Drawing together students' ideas |
| Student engagement with whole-class discussion |
| **Return of student work** |
| Providing formative feedback |
| Student responses to formative feedback |
| **Individual working time** |
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| **Collaborative work** |
| Fostering peer assessment and questioning |
| Monitoring and assisting individual students |
| Student interaction with teacher during group work |
| Student interaction with peers during group work |
| **Students' evaluation of student work** |
| Assessing samples of written student work |
| Student interaction with teacher during group work |
| Student interaction with peers during group work |

Where is the technology is used?

Where are the critical points?

What is the impact on the formative assessment process?

| Technology | Use | School | Process | Purpose | Teacher assessing *or* student assessing | Type |
|---|---|---|---|---|---|---|
| iPad | Questions are sent to students electronically to complete. | DF | Teacher gains overview of correct responses and student working. | Diagnostic work. | Teacher | Replacement with benefit of speed and easy access. |
| iPad and IWB | Student work is completed on iPads displayed for group and discussion. | DF | Facilitates group discussion. | Teacher selects student work that leads to useful class discussion about misconceptions. | Both | Replacement with benefit of easy access. |
| iPad | Students work in pairs on iPads. | DF | Replacement | Students engage in peer assessment and discussion. | Students | Replacement. |
| iPad | Students display and share solutions to 'mirrored' questions. | DF | Replacement | Peer assessment and discussion. | Students | Replacement or different process. |

# Initial conclusions

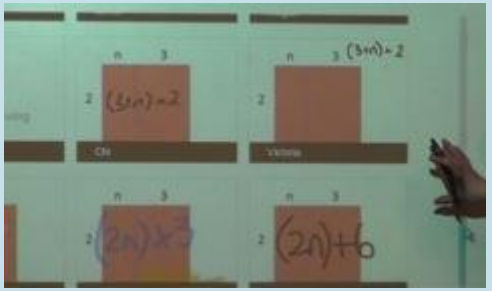
In some cases the technology:

1. Made information on student performance readily accessible by processing and summarising data.

   e.g. class profiles


2. Made information on individual students' progress easily accessible at frequent intervals during lessons.

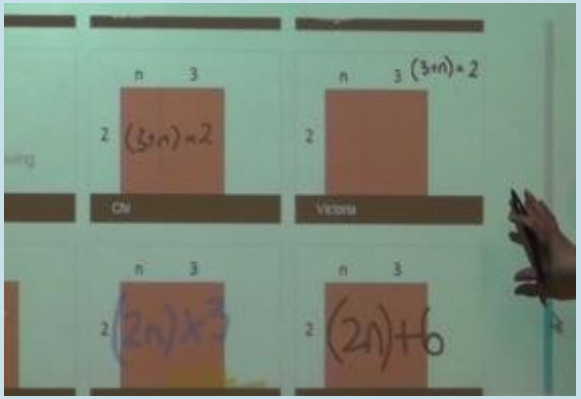
   e.g. *Showbie*, *Nearpod*.

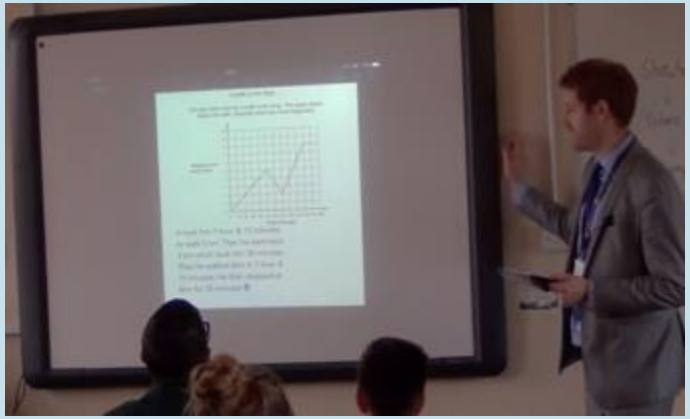


# Interim conclusions

3. Allowed the teacher to select and display appropriate student work in order to discuss and address misconceptions.

   e.g. *Nearpod*, *Showbie*, or connecting individual iPads to the Interactive White Board.



# Interim conclusions

4. Saved time for students when drawing graphs or shapes that could be used for other purposes, e.g. comparing, discussing, exploring.

5. Opened up new areas of questioning.