FACHDIDAKTISCHE KONZEPTE

2025, Nikolaus Albrecht

Skript: http://www.sigmadelta.at/

Content:

3_Mathematik und Ergänzung Naturwissenschaften / Chemie

3-1_Dezimalzahlen

3-1-1_Lehrplan

3-1-2_Diagnosefragen

Didaktische Kommentare

- Front Loading (Adam Boxer)
- Means of Participations (Craig Barton)
  - Cold Call
  - Voting Systems
  - Mini Whiteboards
  - Partner Talk

3-1-3_Review (Dezimalzahlen)

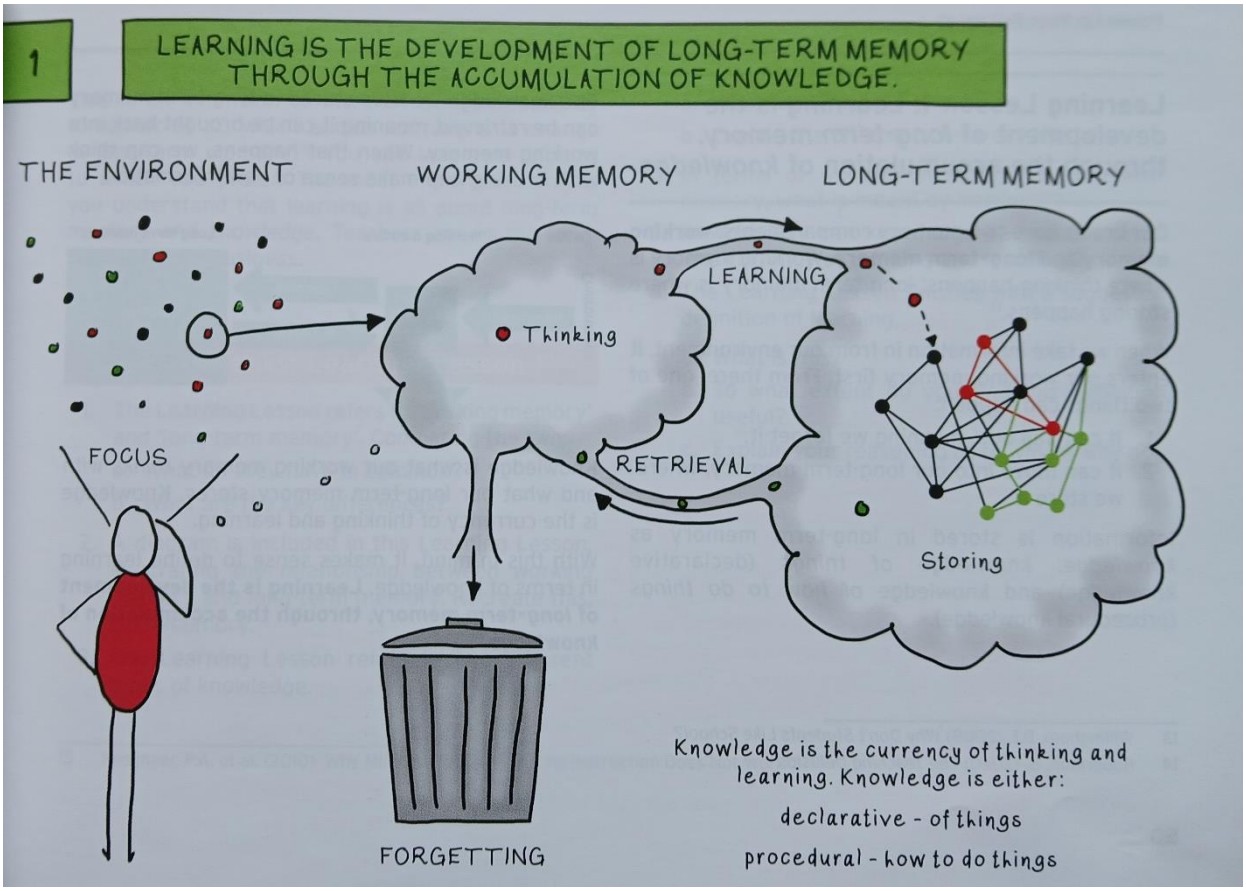
3-1-4_Ressourcen

2_Fachdidaktik Grundlagen

2-1_Lernen & Lang-Zeit-Gedächtnis

Robertson, B.

„Learning is the development of long-term memory, through the accumulation of knowledge."



Quelle: Robertson, B. "Power up your pedagogy"

2_Fachdidaktik Grundlagen

2-2_Gelernt wird, worüber man (intensiv) nachdenkt

Robertson, B.

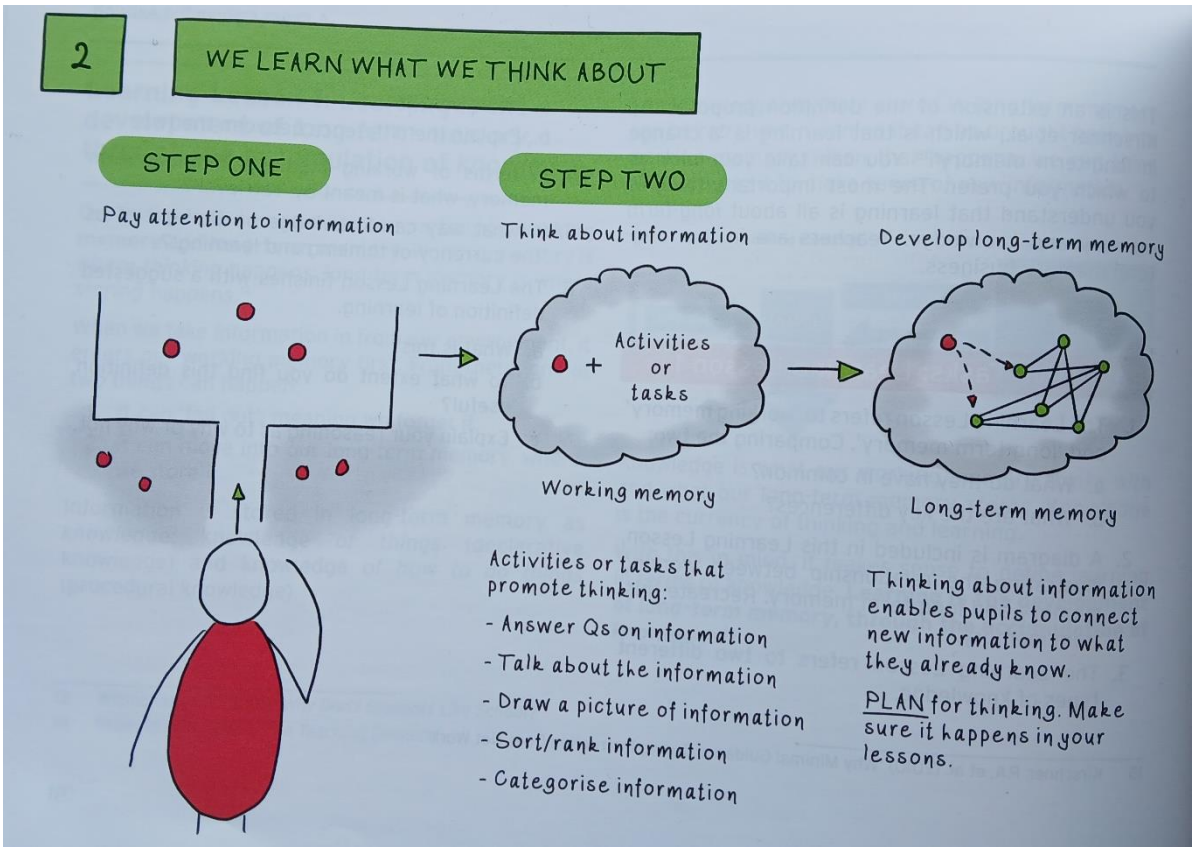
„Nothing can enter long-term memory unless it has first entered working memory."

Willingham, D. T.

"Memory is the residue of thought."

Robertson, B.

„Plan for thinking: Just because students look at information that appears briefly on a slide, listen to something their teacher says, or read something in a textbook, it doesn't mean the will learn anything."



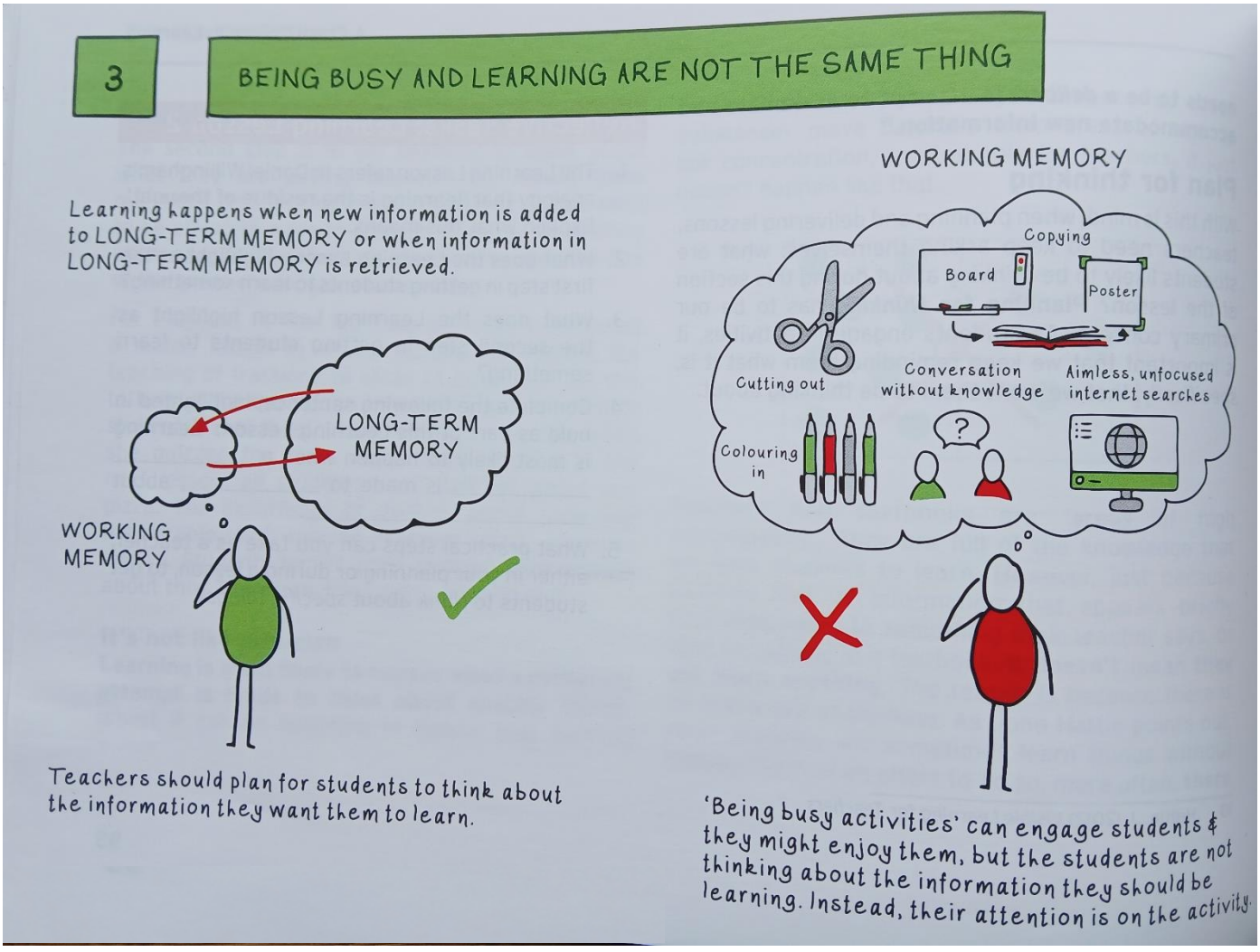
Quelle: Robertson, B. "Power up your pedagogy"

2_Fachdidaktik Grundlagen

2-3_Geschäftig oder beschäftigt zu sein ist nicht dasselbe wie Lernen

Robertson, B.

„Nothing can enter long-term memory unless it has first entered working memory."



2_Fachdidaktik Grundlagen

2-4_Worüber wir nachdenken hängt primär davon ab, was wir wissen

Willingham, D. T.

„Understanding is remembering in disguise."

Kirschner, P.

„What they see will be determined by what they already know."

William D.

„The purpose of the curriculum is to build up the content of long-term memory so that when students are asked to think, they are able to think in mor powerful ways."

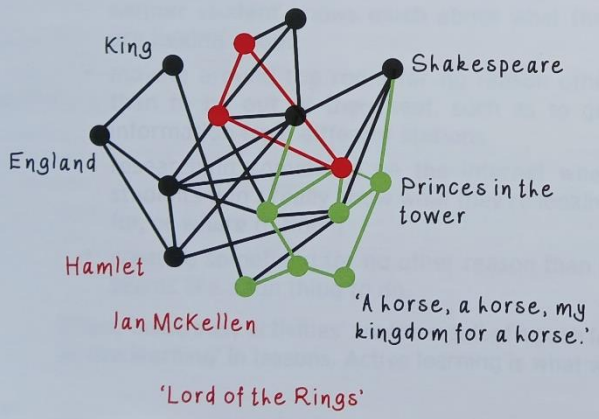
4

WHAT WE THINK DEPENDS ON WHAT WE KNOW

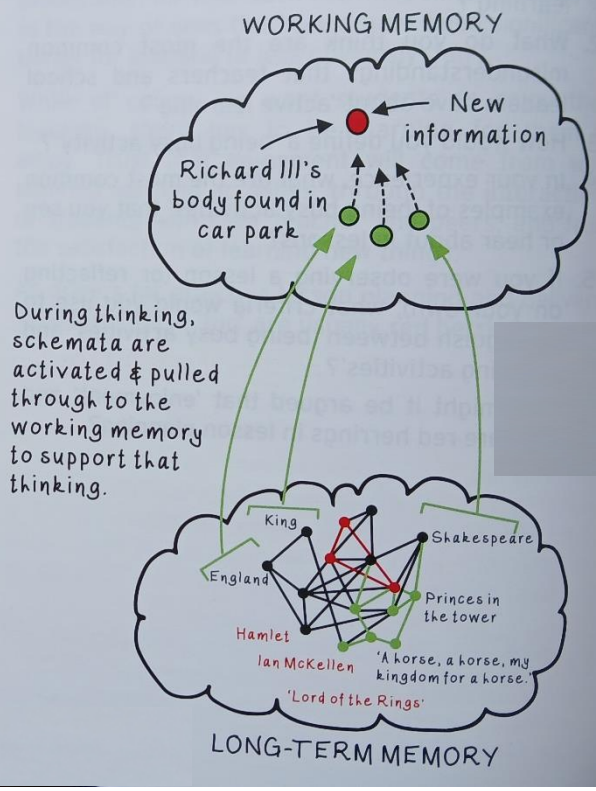
What is a schema?

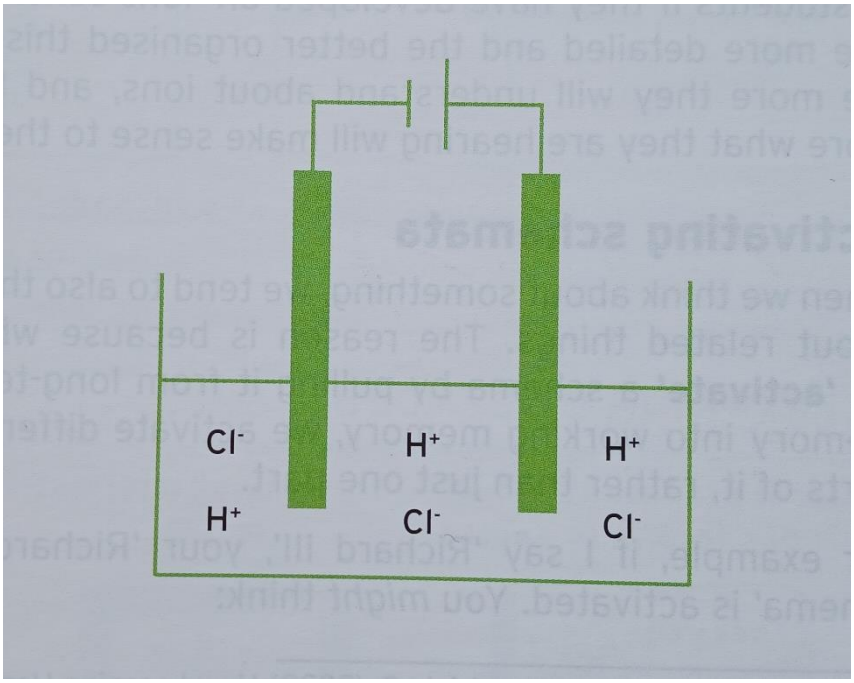
A schema is a knowledge construct. It is made up of all your knowledge linked with that subject - both direct & less obvious connections.

Richard III Schema



How does thinking use schemata?





2_Fachdidaktik Grundlagen

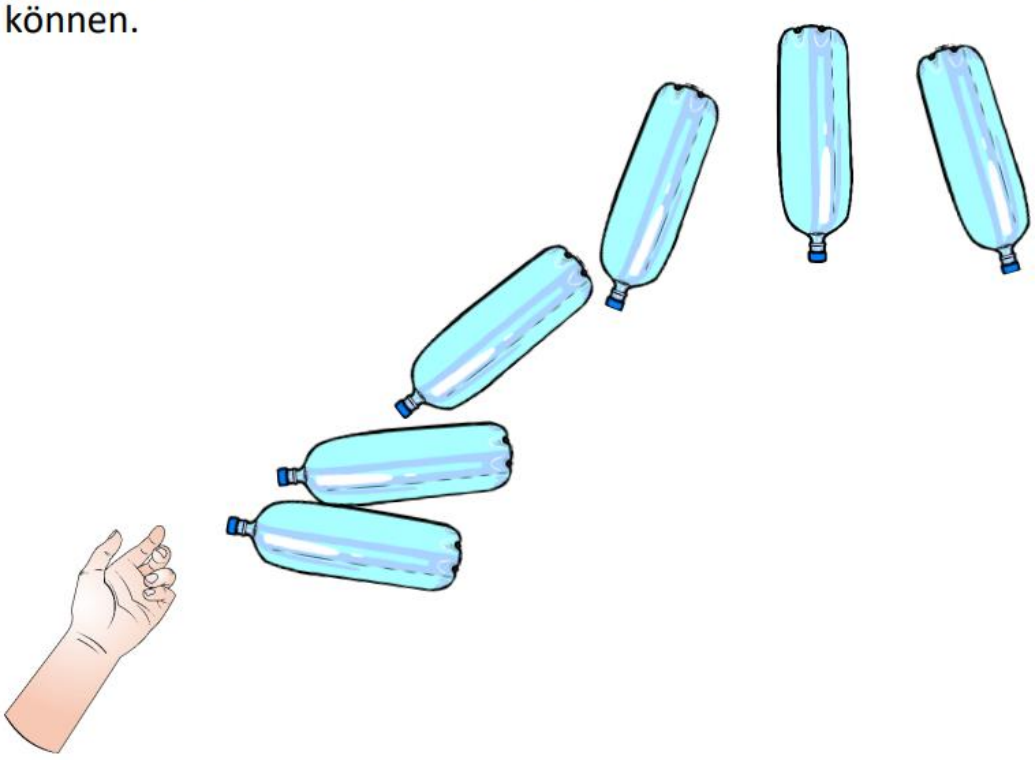
2-5_Ein „Lernprodukt“ muss nicht notwendigerweise Aufschluss auf das tatsächliche Lernen geben

Beispiel aus der Mathematik: „Bottle Flipping“ …

… und anschließend (als Hausübung) **einen Bericht** darüber verfassen.

Bottle Flipping …

… um die Gesetze der Wahrscheinlichkeit besser verstehen zu können.

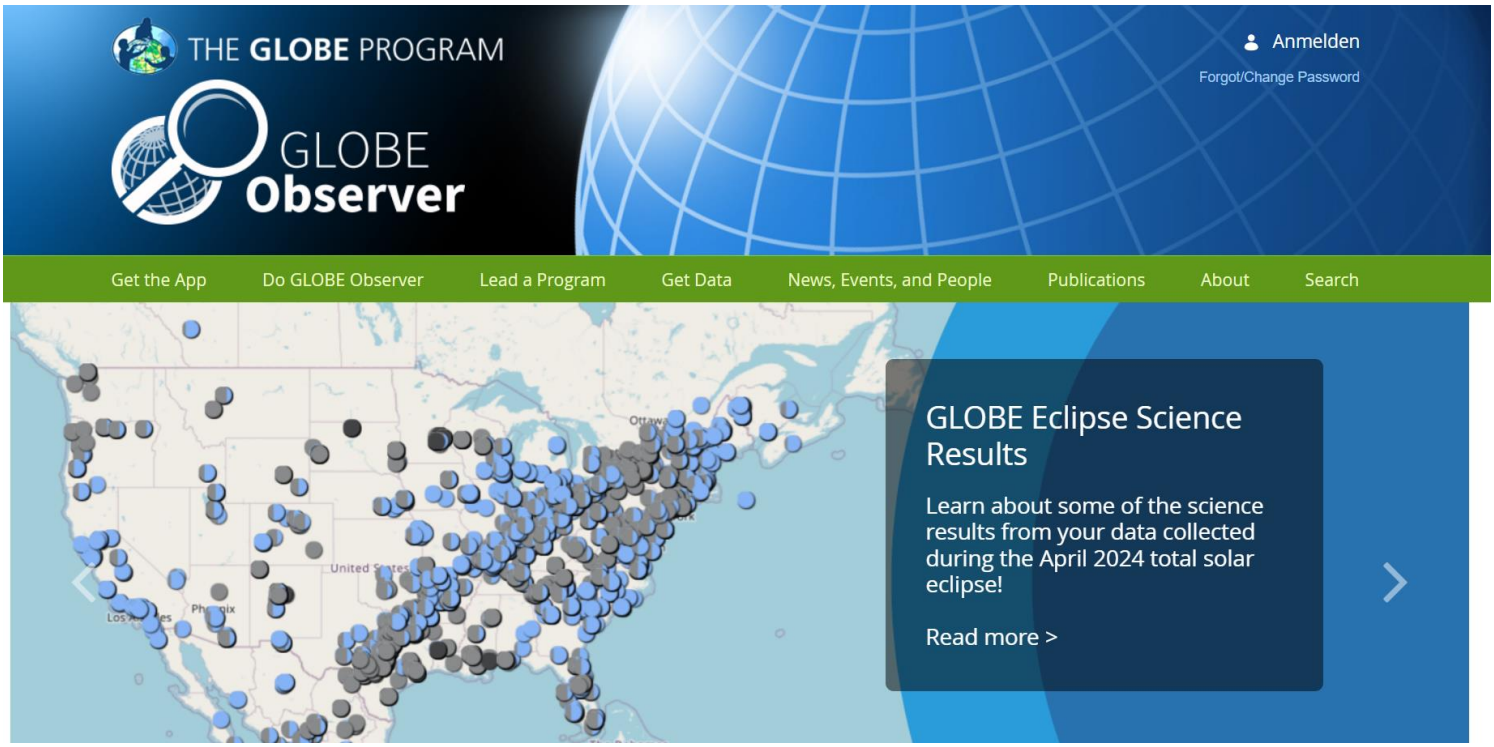


Allerdings: Der Teufel steckt im Detail …

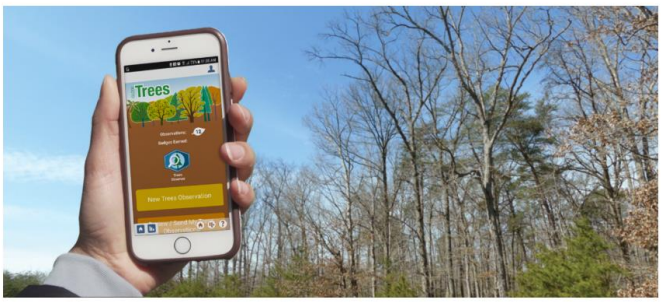
Oder mit Theodor Fontane: „Der Zauber steckt immer im Detail.“

Beispiel aus der Geometrie / „GlobeObserver“

https://observer.globe.gov/

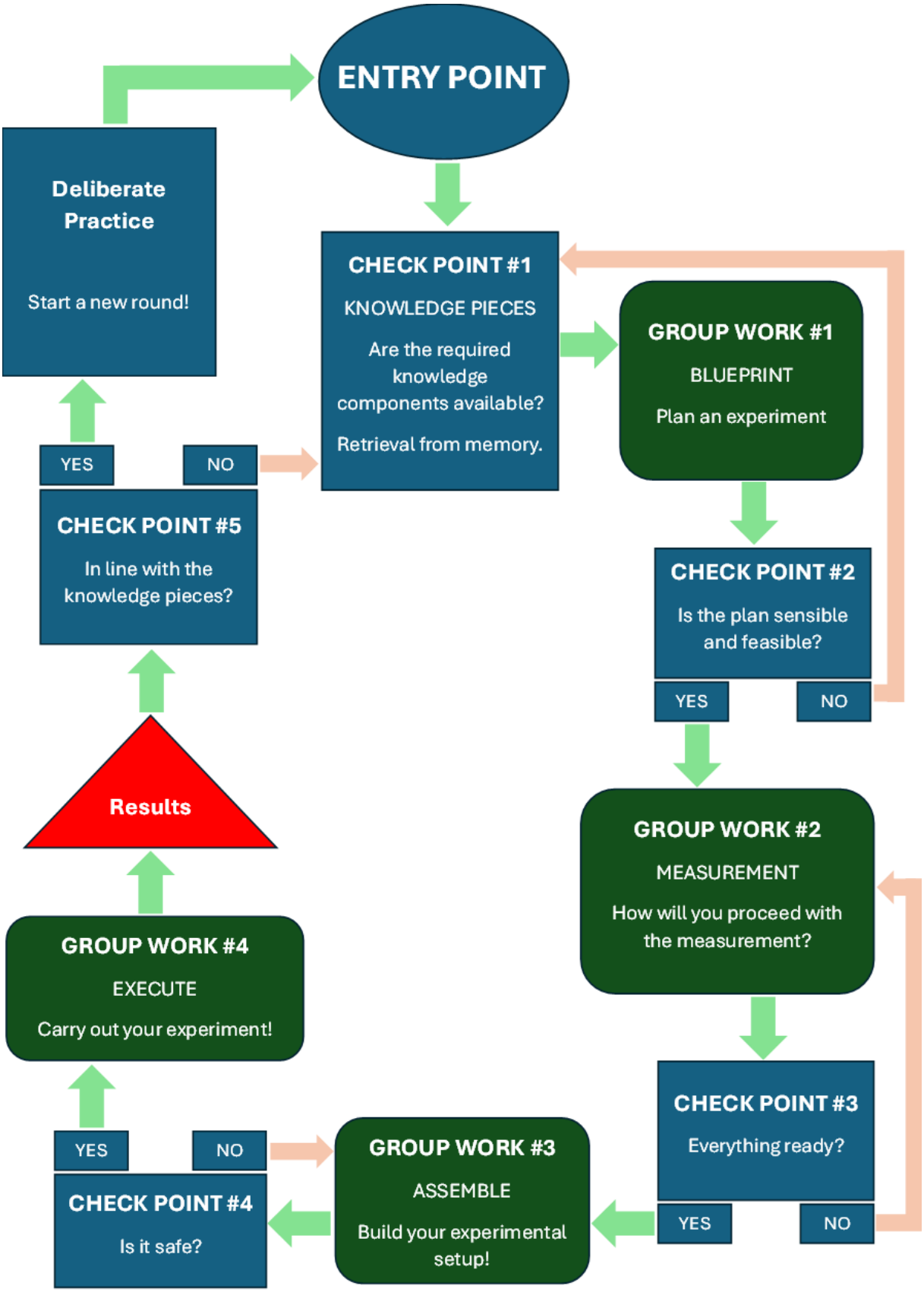


What is GLOBE Trees?

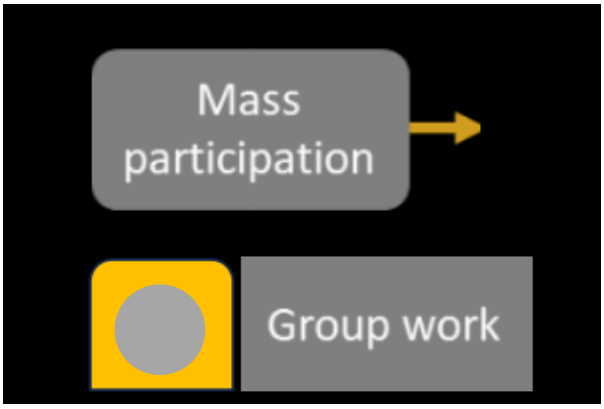


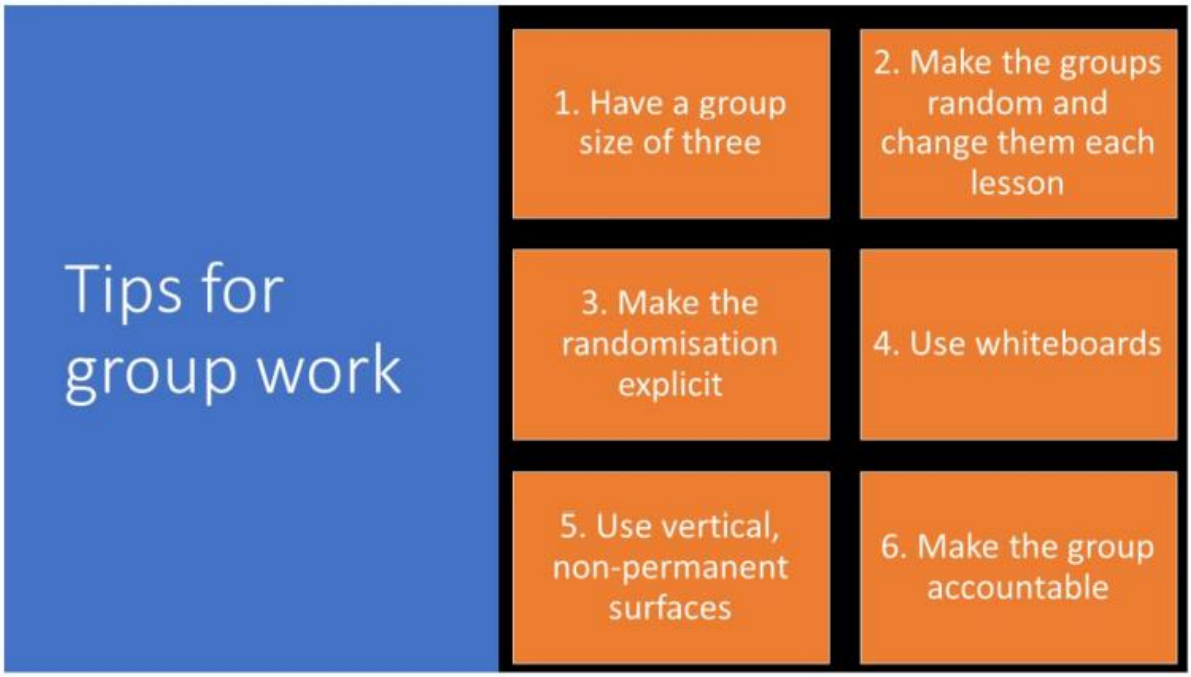
GLOBE Trees is an app-based tool that will help you estimate tree height. Once you have downloaded the GLOBE Observer app and created an account, the Trees tool will guide you through the observation process. Required steps include selecting a tree and using your device to measure the angle from the bottom to the top of the tree, walking to the tree and counting your steps (to determine the distance) and reporting on surface conditions. The app will use that information to calculate an estimate of the tree's height. Optional steps are taking a photograph of the tree and measuring the circumference of the tree. Even a basic observation without optional elements is valuable!

Querverbindung zu Laborexperimente / hier insbes. Chemie

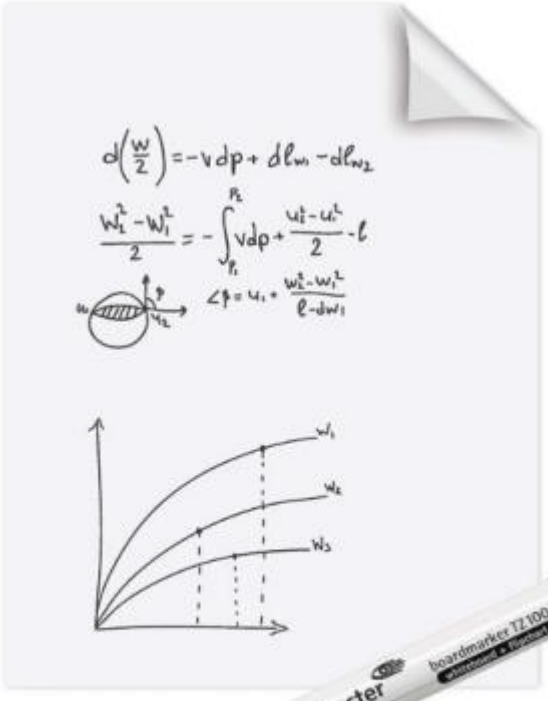


Didaktischer Kommentar





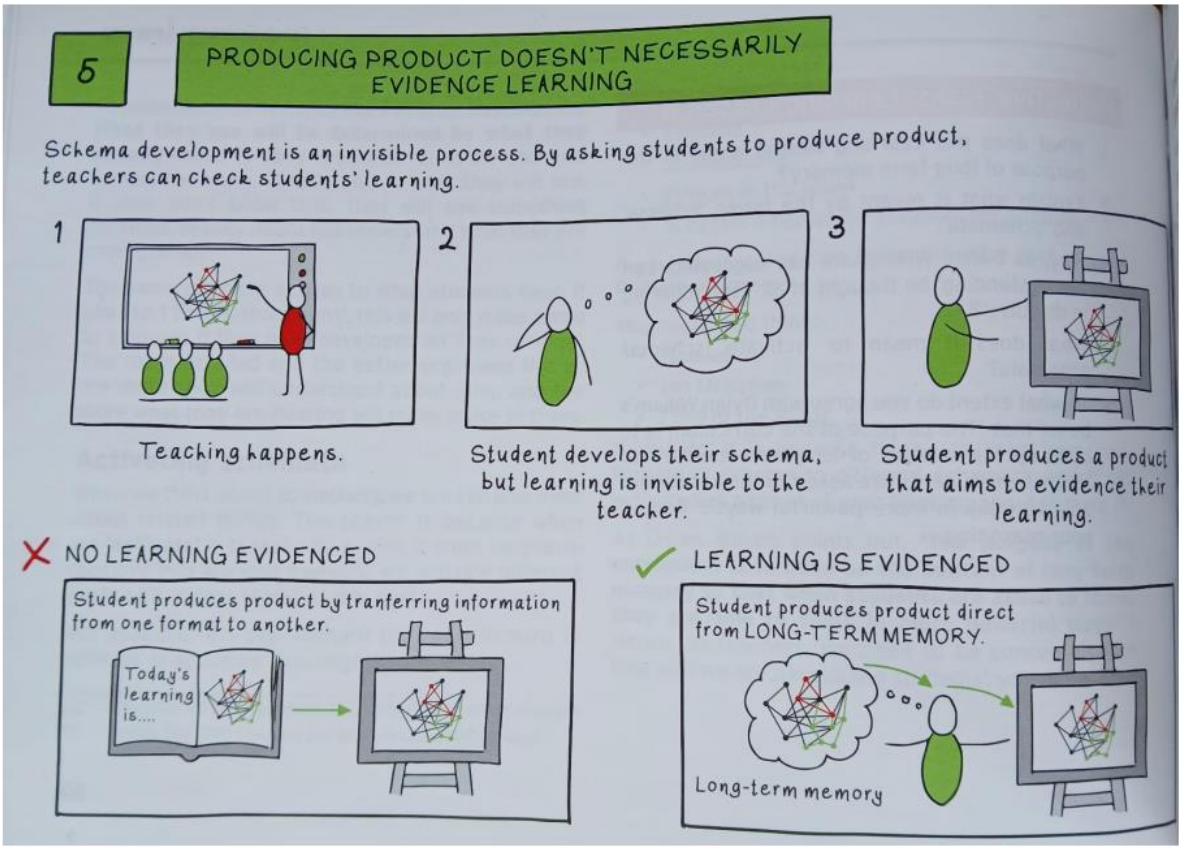

WHITEBOARD • 25 static writing sheets • 60 x 80 cm
Magic-Chart
EASY TO USE
STICKS TO ANY FLAT SURFACE
REPOSITION ANYTIME
EASY TO RE-USE


$d\left(\frac{w}{2}\right) = -v\,dp + dl_{w_1} - dl_{w_2}$
$\frac{w_2^2 - w_1^2}{2} = -\int_{p_1}^{p_2} v\,dp + \frac{u_2^2 - u_1^2}{2} \cdot l$
$\angle\varphi = u_1 + \frac{w_2^2 - w_1^2}{l \cdot dw_1}$
w_1
w_2
w_3


Legamaster
boardmarker TZ 100

Lernprodukt: Poster erstellen

If students were allowed to refer to their notes while making their poster, either individually or in groups, **this isn't evidence of anyone's learning**.

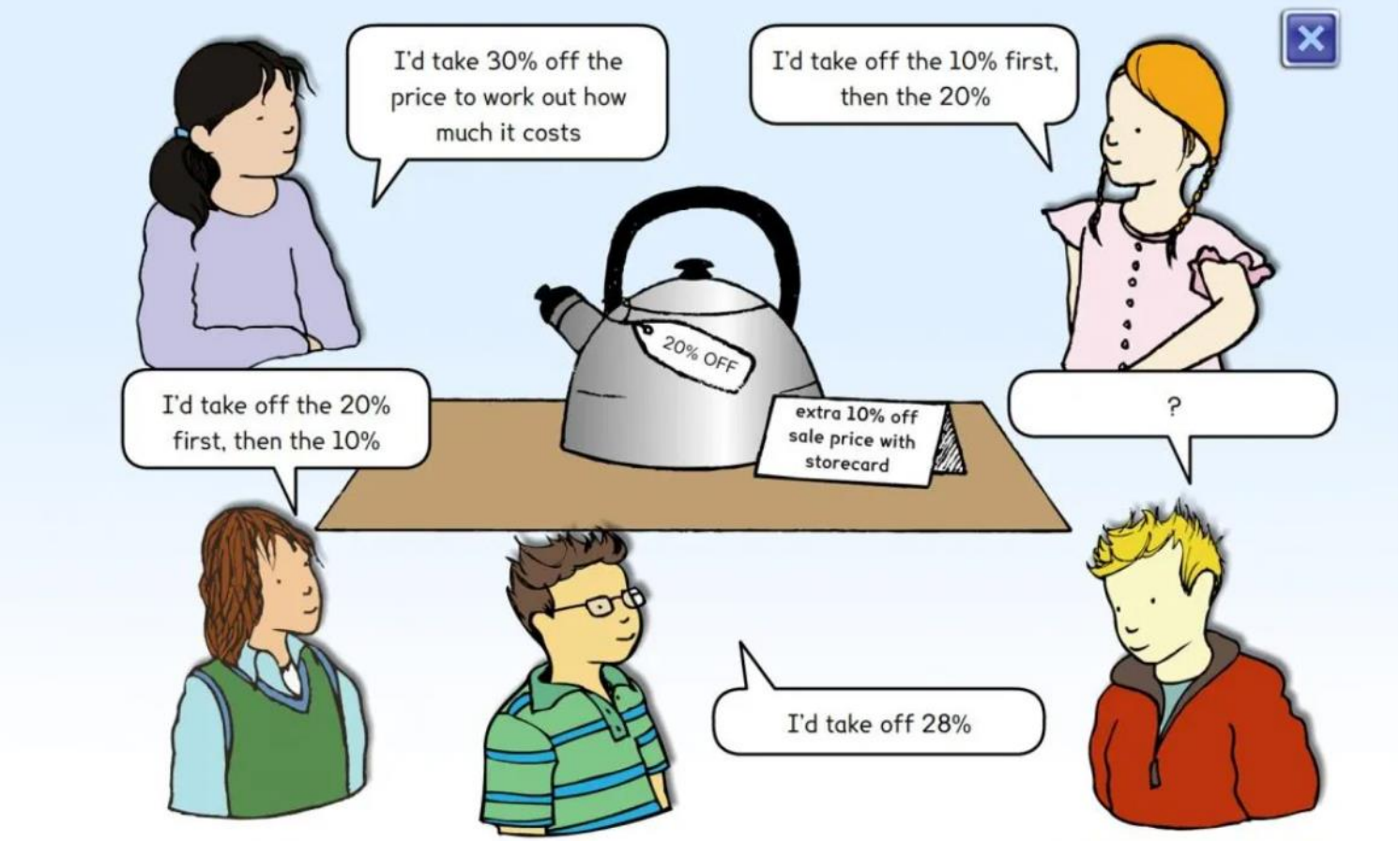


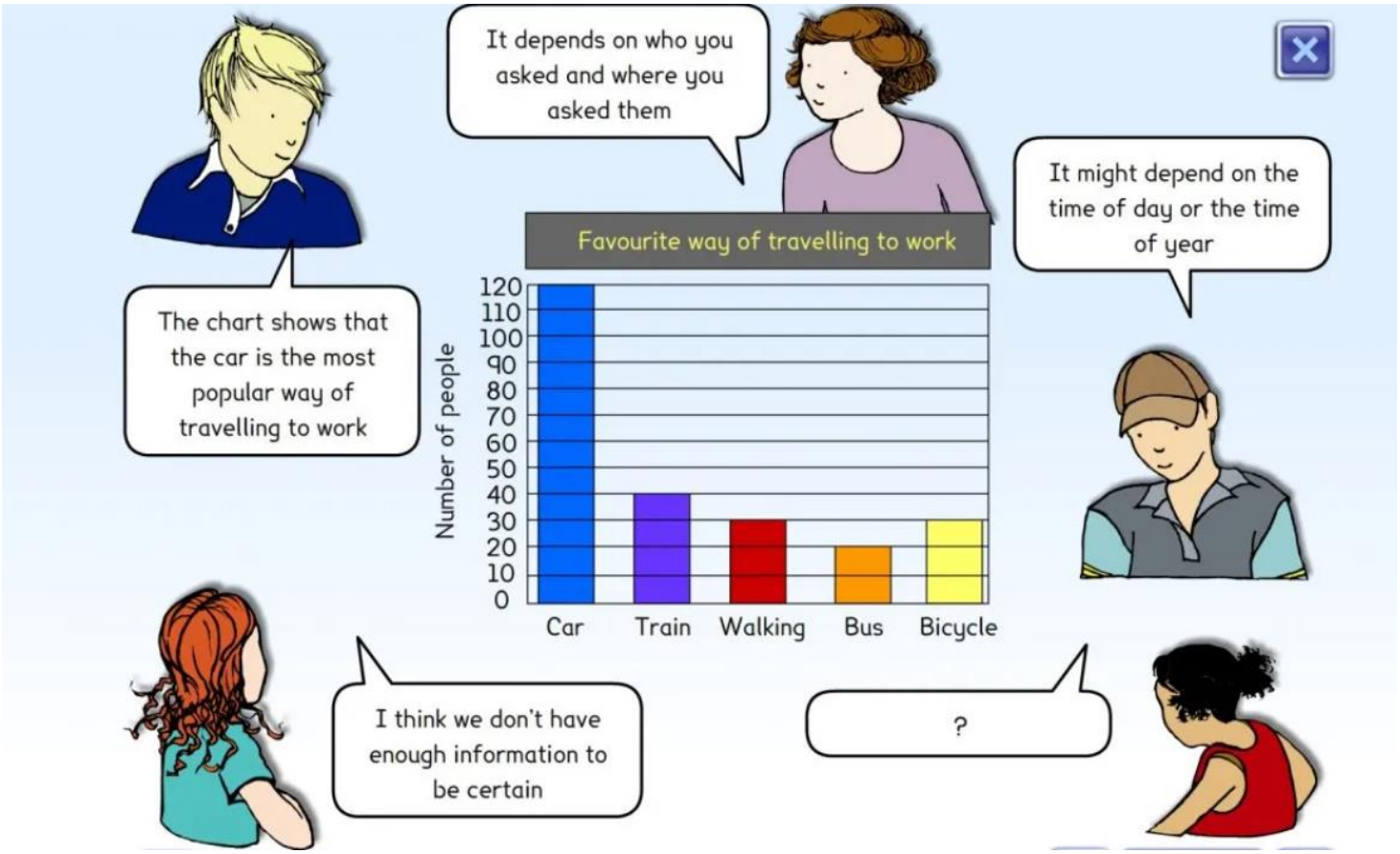
2_Fachdidaktik Grundlagen

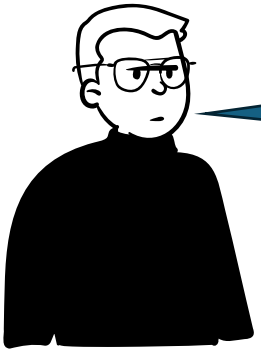
2-6_Fehlvorstellungen / Misconceptions

Beispiel aus der Mathematik:

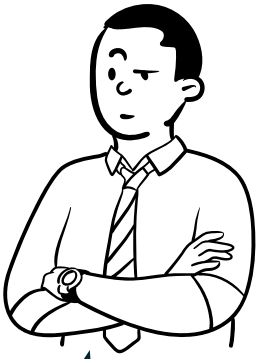
(Spotlight „Assessment“: Concept Cartoons)




It depends on who you asked and where you asked them
It might depend on the time of day or the time of year
The chart shows that the car is the most popular way of travelling to work
Favourite way of travelling to work
Number of people
120
110
100
90
80
70
60
50
40
30
20
10
0
Car
Train
Walking
Bus
Bicycle
I think we don't have enough information to be certain
?

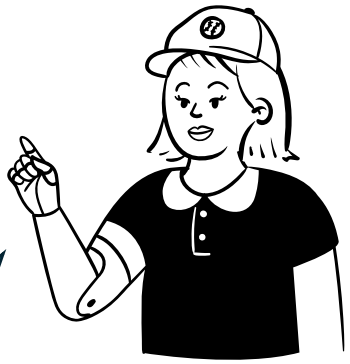


When we divide numbers, they always get smaller!



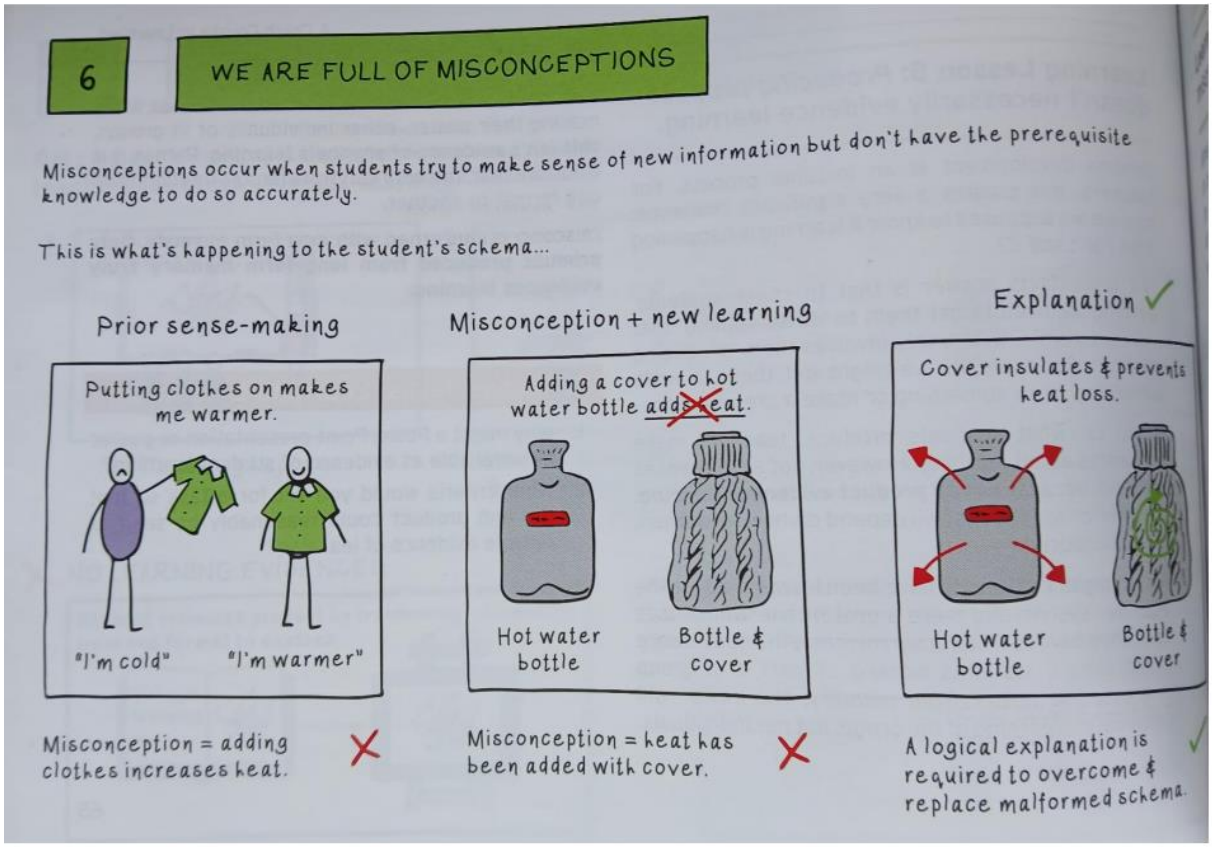
When we divide by some numbers, they get bigger!

If we divide by zero, we will always get zero.



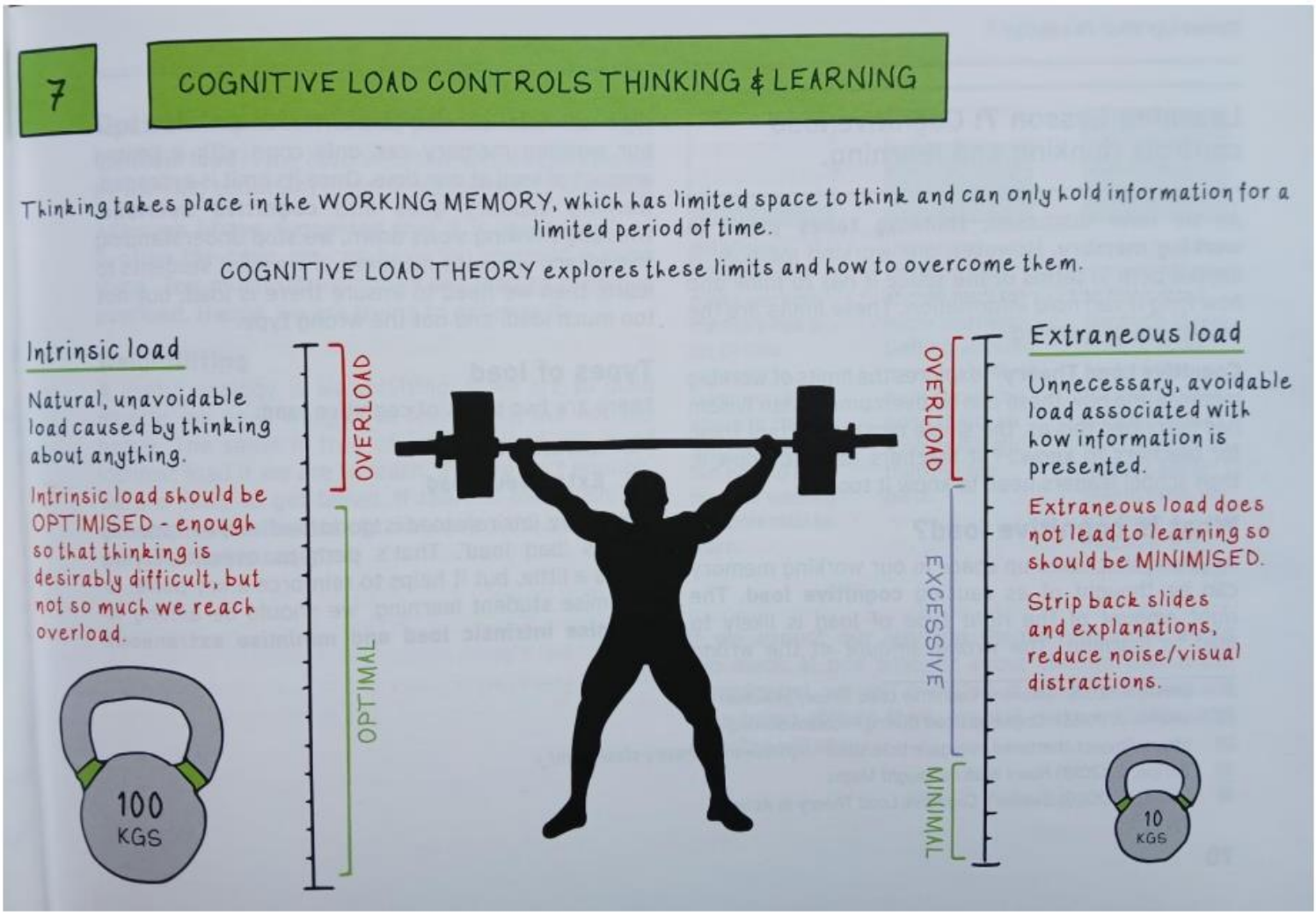
Nothing changes if we divide by 1

Bruce Robertson: „Power up your Pedagogy – The illustrated Handbook of Teaching"



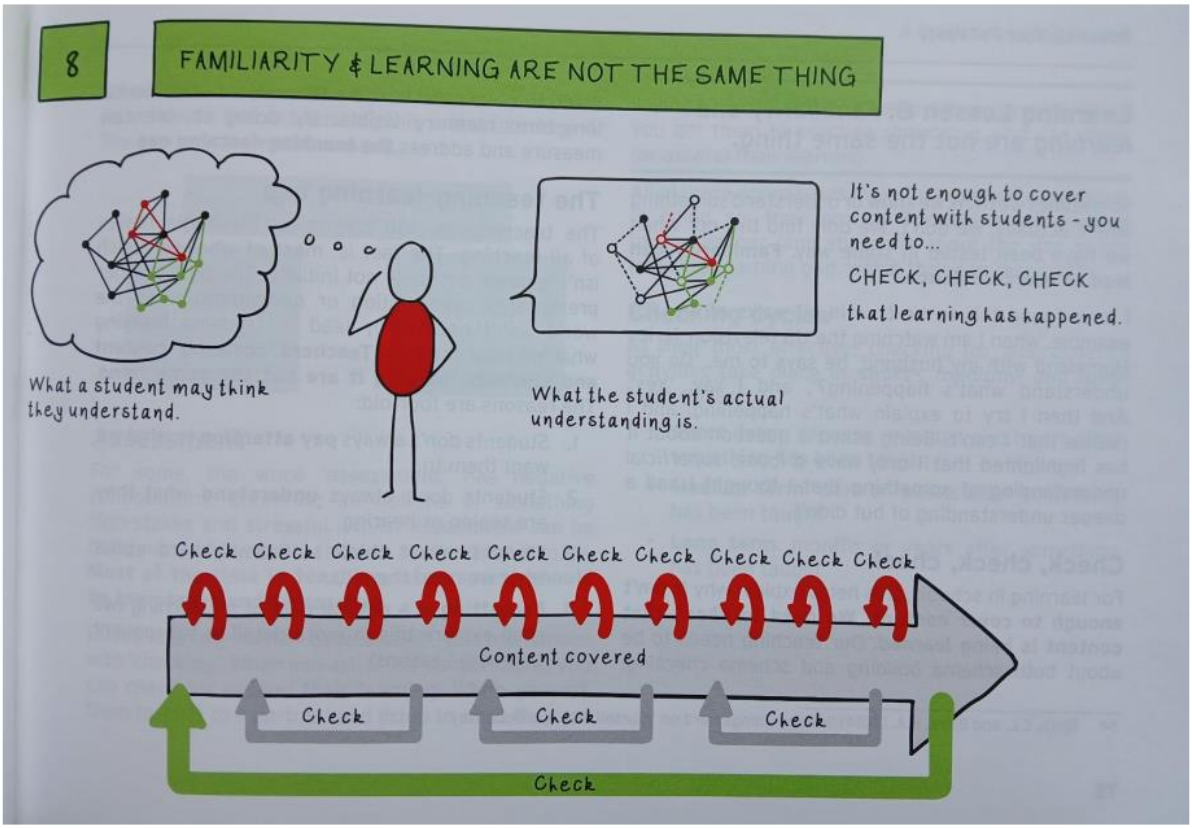
2_Fachdidaktik Grundlagen

2-7_ Cognitive Load & Learning



2_Fachdidaktik Grundlagen

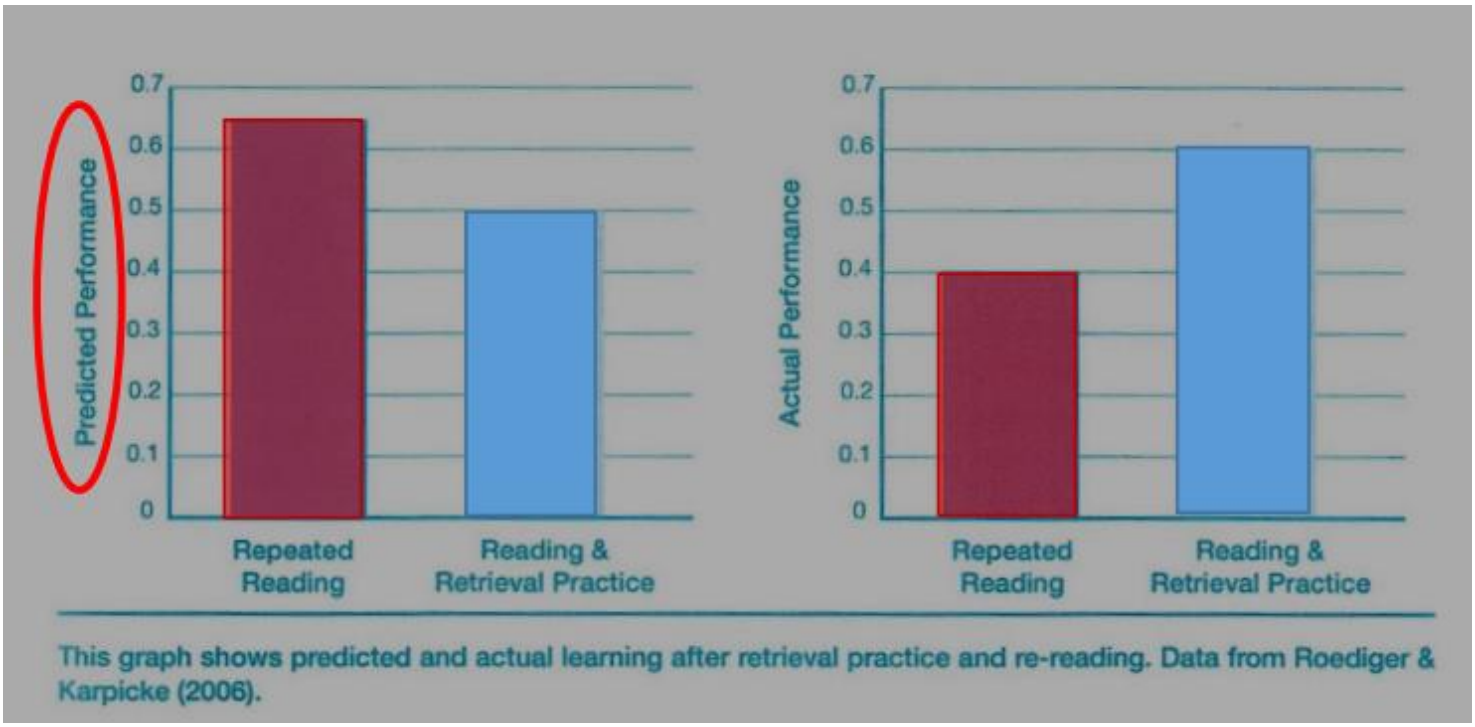
2-8_ Vertrautheitsgefühl ist oftmals irreführend



Die SchülerInnen werden die Überlegenheit der Retrieval Practice **leugnen** (siehe nachfolgende Graphik: von den SchülerInnen vorhergesagte Testperformance und die tatsächliche Testperformance).

SchülerInnen werden stets behaupten, dass sich das wiederholte Durchlesen (Re-reading) ihrer Unterlagen auszahlt. Das erneute Durchlesen der Unterlagen flößt ihnen Vertrautheit mit dem Material ein – Retrieval Practice hingegen zeigt auf, wie langsam sie tatsächlich voran kommen.

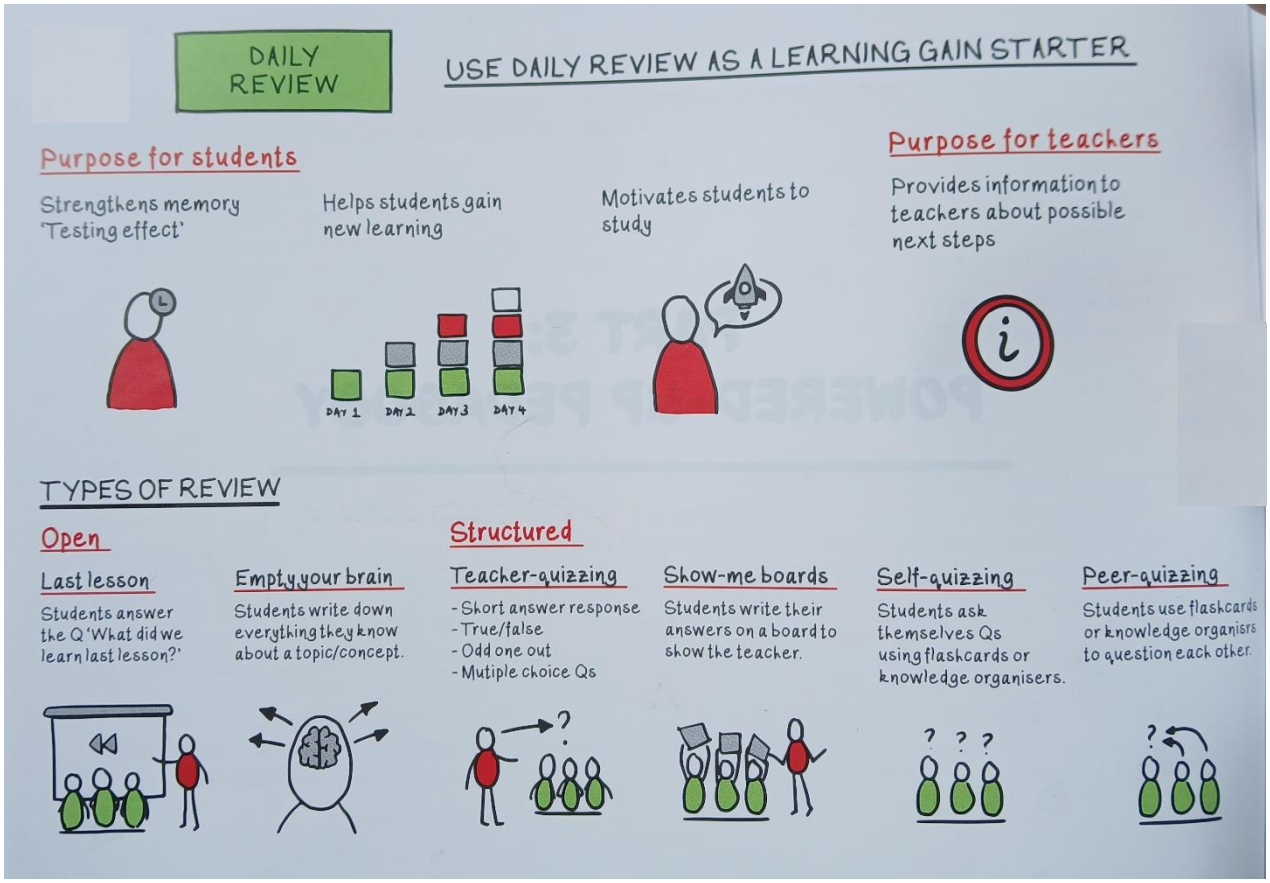
Der Wirklichkeit kann man sich allerdings nicht gänzlich entziehen (… enttäuschte Gesichter bei der Rückgabe der Schularbeit).



This graph shows predicted and actual learning after retrieval practice and re-reading. Data from Roediger & Karpicke (2006).

Didaktischer Kommentar

Daily Review



Didaktischer Kommentar

Deliberate Practice / Overlearning

https://cirl.etoncollege.com/dont-just-learn-emoverlearn-em/

Don't just learn, overlearn

https://www.scientificamerican.com/article/the-power-of-overlearning/

FEBRUARY 28, 2017 | 4 MIN READ

The Power of Overlearning

It can help to work on something you already know how to do

BY VICTORIA SAYO TURNER

More research ...

https://www.teachingsprints.com/research-hub

Research Hub

Use these research resources to search for and evaluate evidence-informed teaching and learning approaches to guide your Teaching Sprints.

Numeracy / Mathematics

Toolkits and practice guides based on evidence-informed approaches to mathematics instruction.

3_Mathematik

3-1_Dezimalzahlen

3-1-1_Lehrplan

1

Die Schülerinnen und Schüler können
- natürliche Zahlen sowie nichtnegative Dezimal- und Bruchzahlen interpretieren, darstellen und vergleichen,

2

- nichtnegative Dezimal- und Bruchzahlen sowie ganze Zahlen interpretieren, darstellen und vergleichen,

3

- grafisches Darstellen von Zahlen als Punkte am Zahlenstrahl und Ablesen von Zahlen; Lesen großer Zahlen

4

- Wechseln zwischen Bruch- und Dezimaldarstellung in einfachen Fällen (zB $0{,}6 = \frac{6}{10} = \frac{3}{5}$; $1{,}25 = \frac{5}{4}$; $\frac{47}{100} = 0{,}47$)

5

- Vergleichen und Ordnen natürlicher Zahlen sowie nichtnegativer Dezimal- und Bruchzahlen

6

– Wechseln zwischen Bruch- und Dezimaldarstellung auch bei Zahlen mit einfacher periodischer Dezimaldarstellung (zB $\frac{2}{3} = 0{,}666\ldots$; $\frac{1}{9} = 0{,}111\ldots$)

7

– Wechseln zwischen Bruch- bzw. Dezimaldarstellung und Prozentdarstellung (zB $\frac{3}{4} = 75\ \%$; $5\ \% = 0{,}05$)

8

. Geldbeträge werden mehrnamig und ab der [redacted] Schulstufe auch in Kommaschreibweise mit zwei Nachkommastellen notiert.

3-1-2_Diagnosefragen

I= Eedi

What is the width of each of the intervals on the number line?

A $\frac{3}{5}$

B $\frac{1}{3}$

C $\frac{1}{2}$

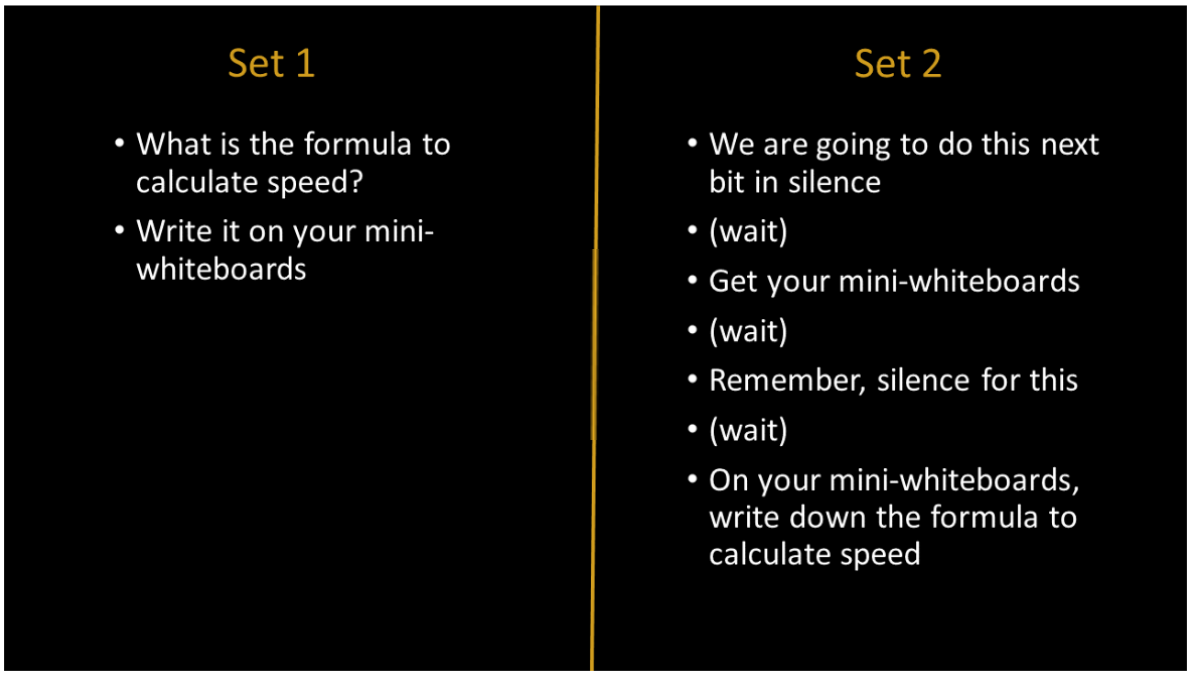
D $\frac{2}{3}$

Didaktischer Kommentar

- “Front loading” (Adam Boxer)
- “Means of participation” (Craig Barton)
    - Cold Call (Doug Lemov)
    - Voting Systems
    - Mini Whiteboards (Craig Barton)
    - Partner Talk

Adam Boxer:

Front-load the means of participation



Craig Barton:

The means of participation

1 Cold Call

(Teach like a Champion | Doug Lemov)

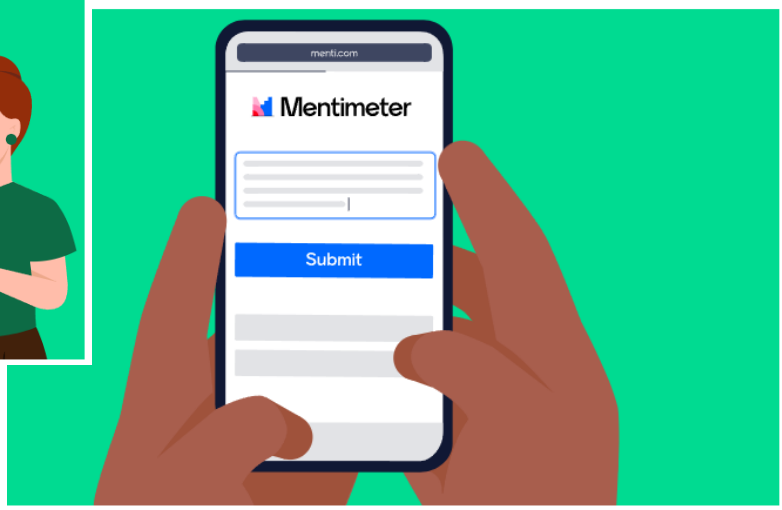
Mentimeter

Interaktives Lernen

Lass alle Schülerinnen und Schüler aktiv an ihrem eigenen Lernprozess mitarbeiten.

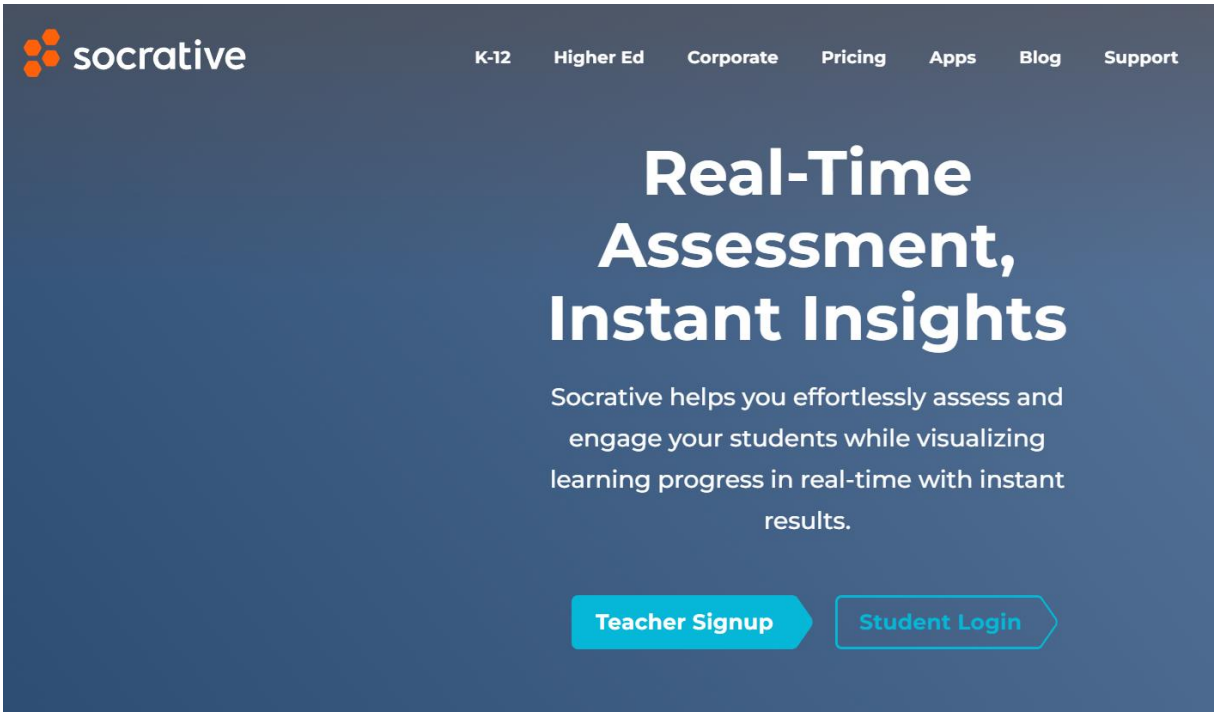
Bereite deine nächste Unterrichtsstunde vor

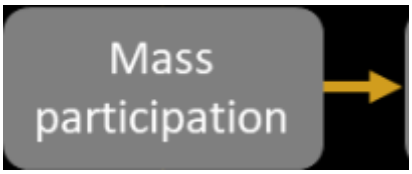
Ja, die Registrierung ist kostenlos



Viele Plattformen ...

1. **Slido** – Great for live polling, Q&A, and quizzes, often used in corporate and educational settings.
2. **Kahoot!** – Primarily a quiz-based platform, but it also allows polls and surveys.
3. **Poll Everywhere** – Offers live audience polling, word clouds, and Q&A sessions.
4. **Vevox** – A real-time engagement platform with polling, quizzes, and surveys.
5. **Wooclap** – An interactive tool with live polls, quizzes, and brainstorming features.
6. **AhaSlides** – A presentation tool with live audience participation, including polls and Q&A.
7. **Pigeonhole Live** – Focuses on Q&A and live polling, often used for conferences and meetings.
8. **TurningPoint** – A classroom and corporate tool for interactive polling and assessments.
9. **ClassPoint** – A PowerPoint add-in for interactive quizzes and audience engagement.
10. **Hypersay** – Allows interactive slides with polls, quizzes, and audience feedback.





Craig Barton

https://tipsforteachers.co.uk/mini-whiteboards-top-5/

Listen to the audio on Spotify or Apple Podcasts

The five tips are:

1. Consider getting A3 mini-whiteboards
2. Make use of both sides of the mini-whiteboard
3. Control the flow of information
4. Question students who show you a blank board
5. Use mini-whiteboards to help check book work

White Board

Dry Erase 21x30cm Double Sided Mini Whiteboard with 16 Pens and 16 Erasers Durable Portable for Classroom, Home and Office

Mass participation

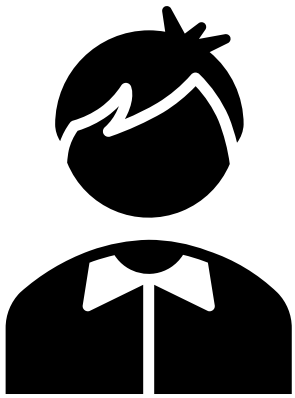
4 Partner talk

1. Give students enough time to think individually first	2. Ask students to write down their answer/key points	3. Use mini-whiteboards to support Partner Talk
4. State who talks first in advance	5. Give a conversation prompt	6. Announce when it is time to switch speaker
7. Ensure students have something to discuss	8. Reinforce the importance of listening	9. Reinforce the idea of rehearsal
10. Better too short than too long	11. Be careful not to get in the way	12. Combine Partner Talk with Cold Call
13. Use Partner Talk following a check for understanding	14. Ask questions to find the best paired discussions to share	15. Consider using the 4-2 approach for longer tasks

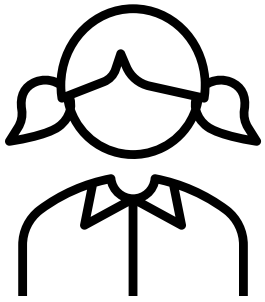
Back to first DQaDay:

Can you explain what mistake each of these students has made?

I think the answer is A because you just do the 3 at one end divided by the 5 at the other to split the line up



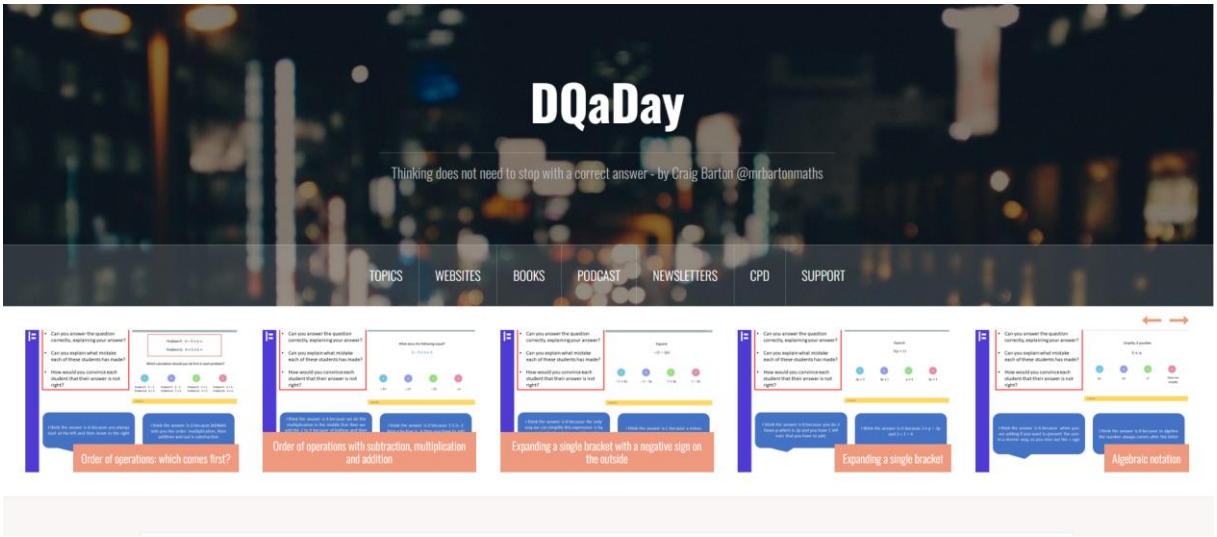
I think the answer is B because there are 3 dashes between 3 and 5 which gives us the denominator for the answer. As it has only highlighted one dash the answer becomes 1/3.



How would you convince each student that their answer is not right?

DQaDay Website (Craig Barton)

https://www.dqaday.com/



Back to Decimal Numbers:

... and some more Diagnostic Questions

Q1

How should you say this number?

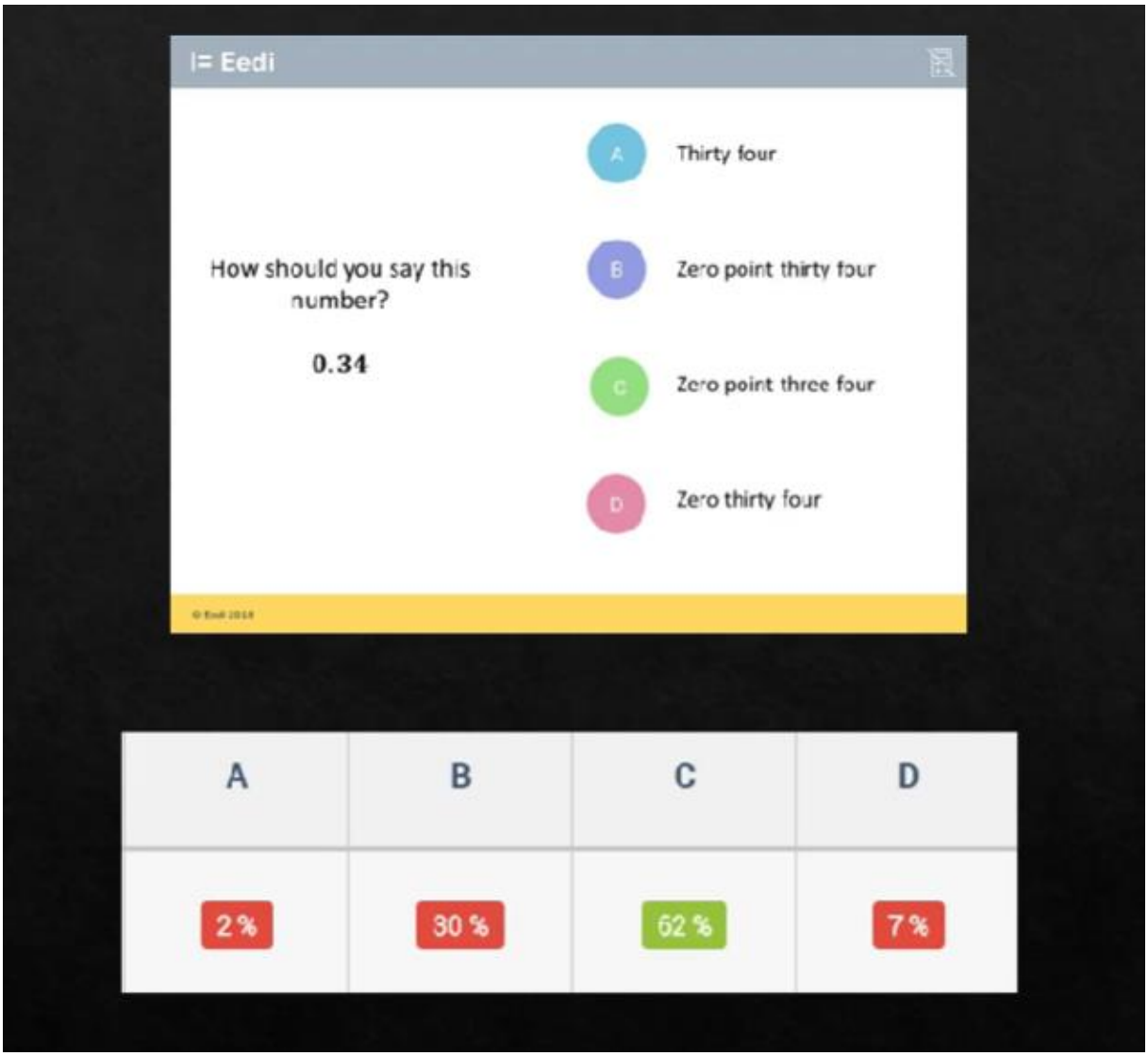
0.34

A Thirty four

B Zero point thirty four

C Zero point three four

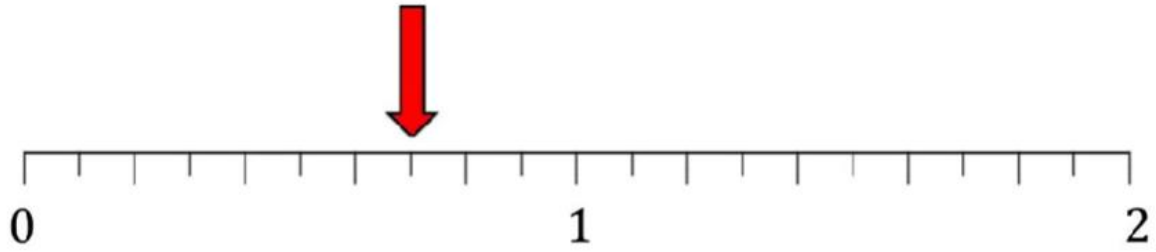
D Zero thirty four


Eedi
How should you say this number?
0.34
A
Thirty four
B
Zero point thirty four
C
Zero point three four
D
Zero thirty four

A	B	C	D
2 %	30 %	62 %	7 %

Q2

What number is the arrow pointing to?

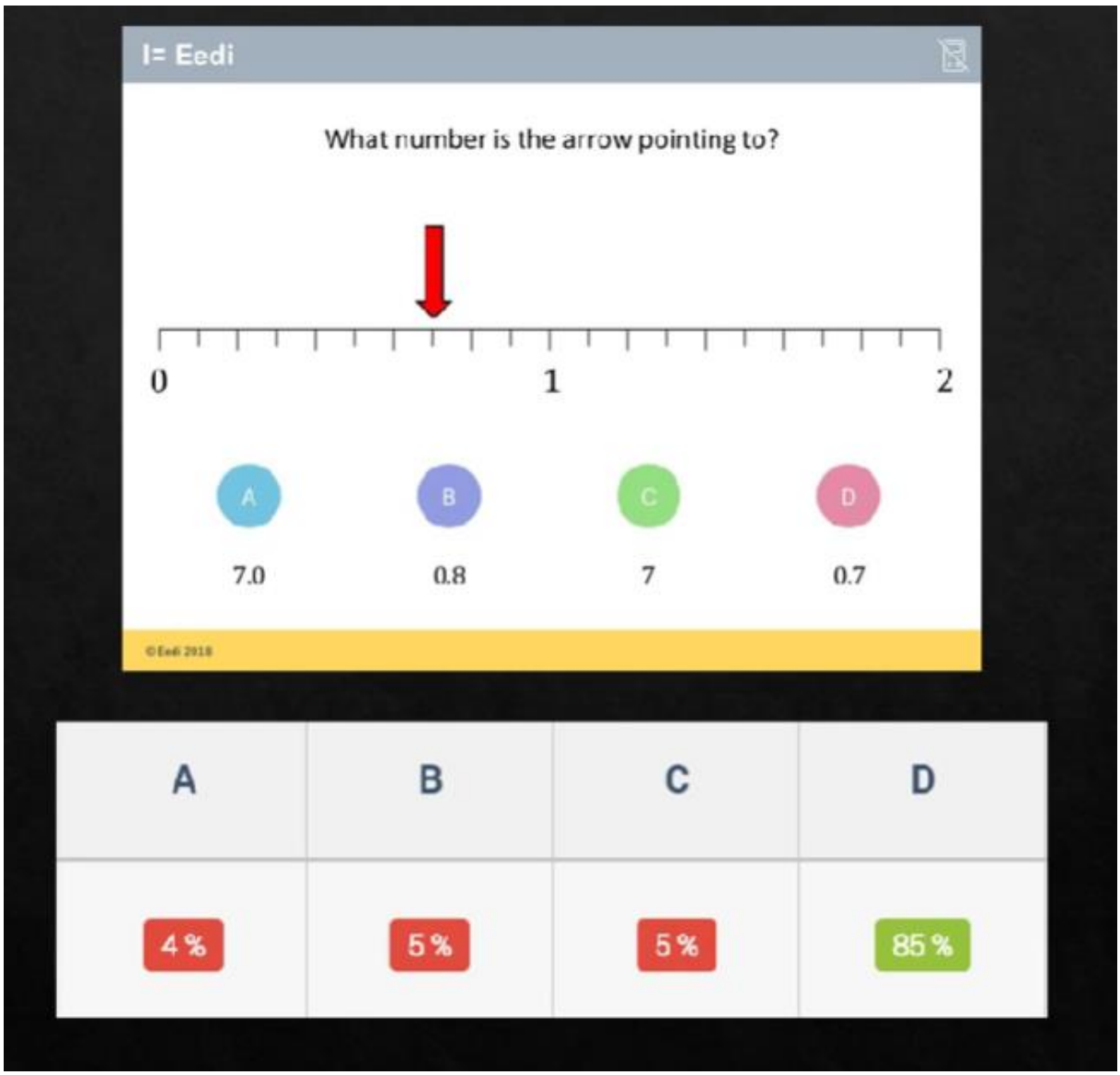


A 7.0

B 0.8

C 7

D 0.7


I= Eedi
What number is the arrow pointing to?
0
1
2
A
B
C
D
7.0
0.8
7
0.7
©Eedi 2018

A	B	C	D
4 %	5 %	5 %	85 %

Q3

Tom and Katie are arguing about numbers.

Tom says $5.1 < 5.10$

Katie says $5.1 > 5.01$

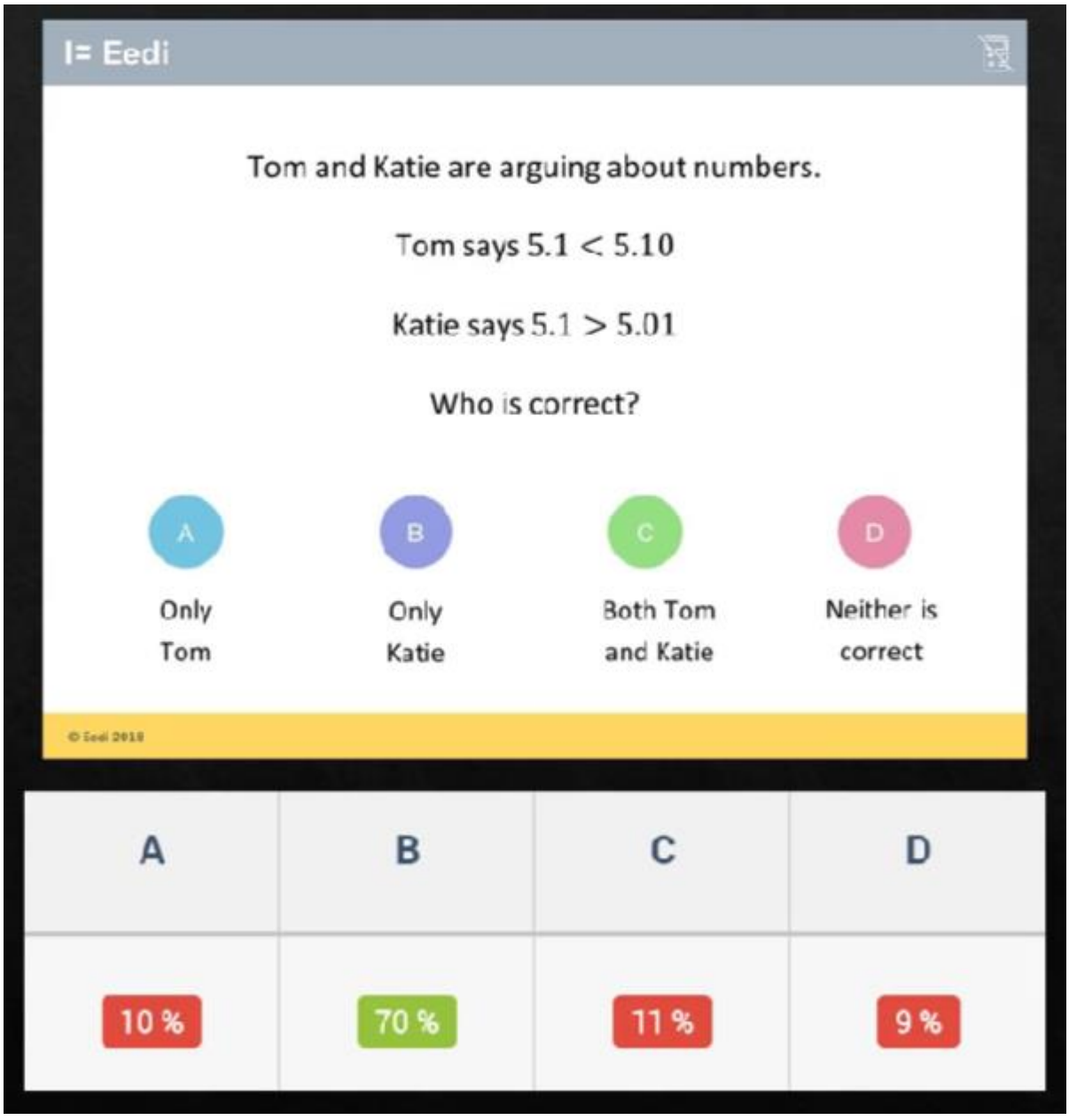
Who is correct?

A Only Tom

B Only Katie

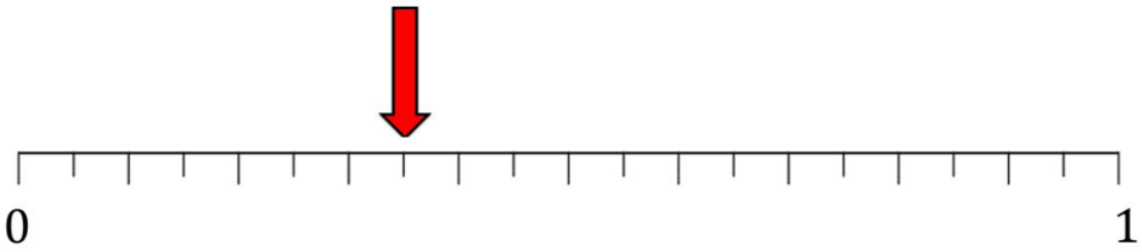
C Both Tom and Katie

D Neither is correct


I= Eedi
Tom and Katie are arguing about numbers.
Tom says $5.1 < 5.10$
Katie says $5.1 > 5.01$
Who is correct?
A
Only Tom
B
Only Katie
C
Both Tom and Katie
D
Neither is correct
© Eedi 2018
A
B
C
D
10 %
70 %
11 %
9 %

Q4

What number is the arrow pointing to?



A 0.14

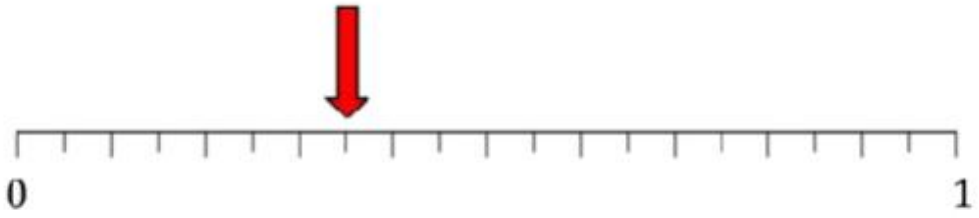
B 0.07

C 0.35

D 0.7

I= Eedi

What number is the arrow pointing to?



A 0.14

B 0.07

C 0.35

D 0.7

©Eedi 2018

A	B	C	D
6 %	23 %	48 %	24 %

Q5

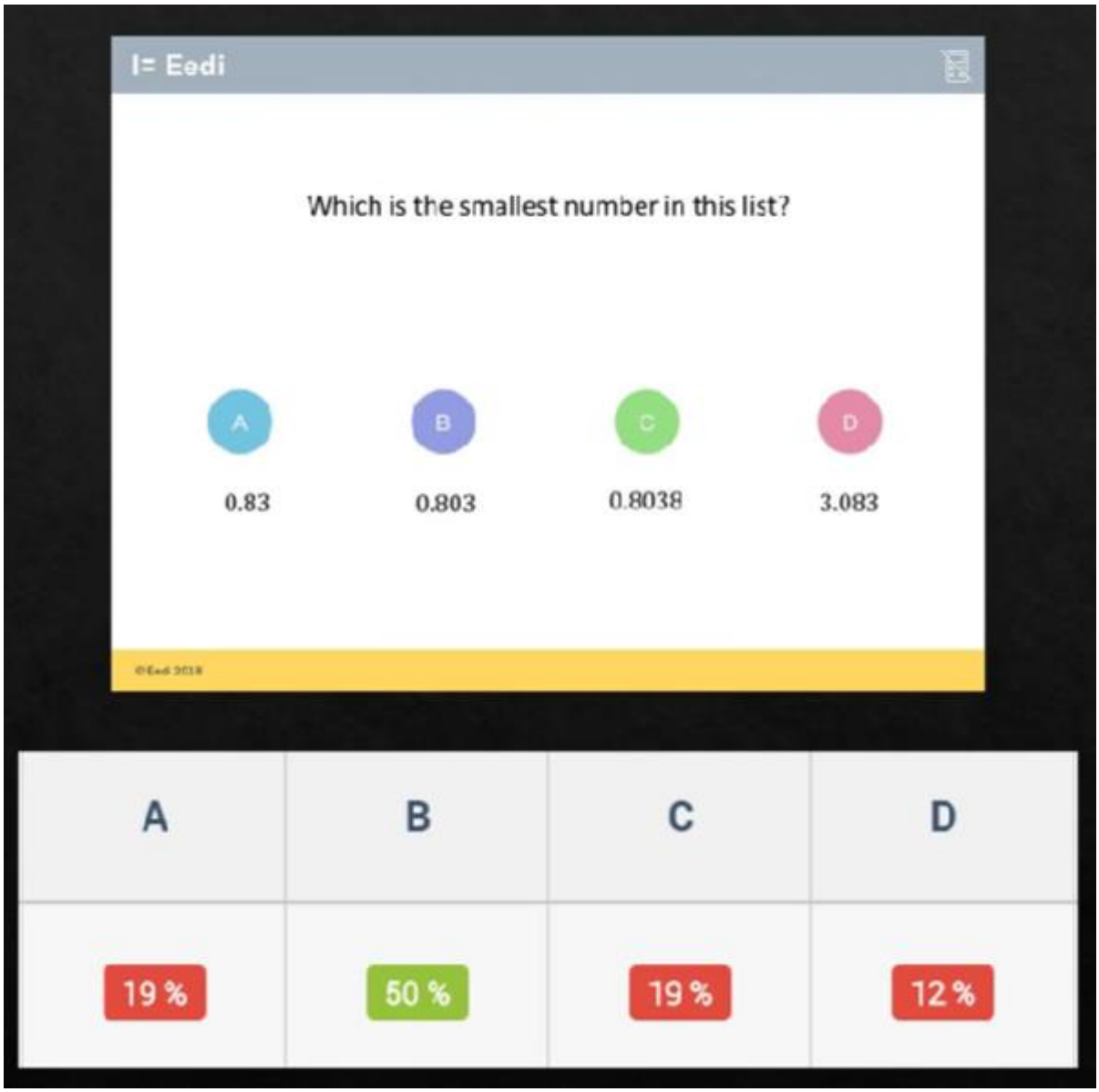
Which is the smallest number in this list?

A 0.83

B 0.803

C 0.8038

D 3.083

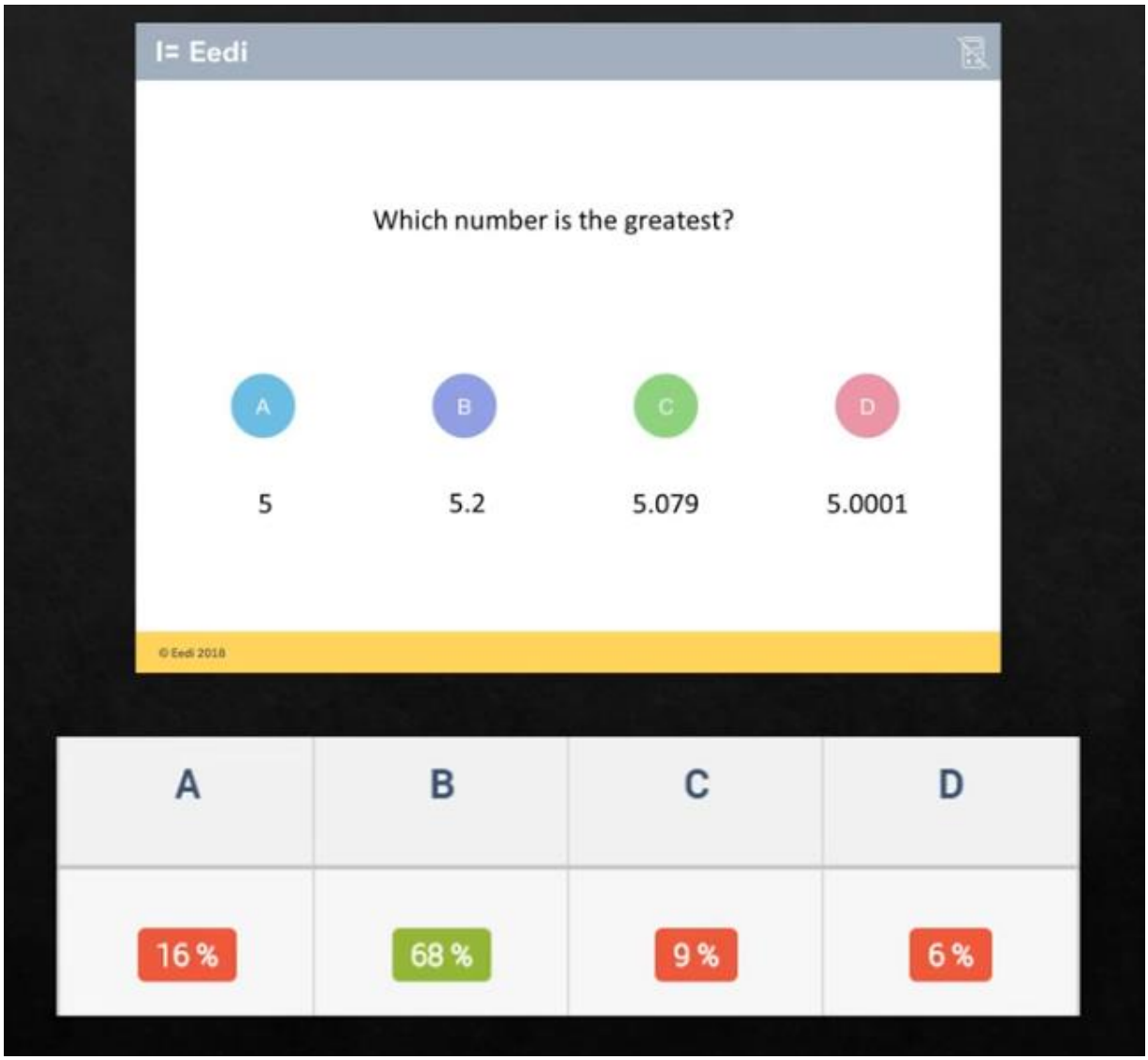


A	B	C	D
19 %	50 %	19 %	12 %

Q6

Which number is the greatest?

A	B	C	D
5	5.2	5.079	5.0001


I= Eedi
Which number is the greatest?
A
B
C
D
5
5.2
5.079
5.0001
© Eedi 2018
A
B
C
D
16 %
68 %
9 %
6 %

Q7

Put these numbers in order, starting with the smallest:

0.4 –0.35 0.45 –0.3 0.355

A	0.3	0.35	0.355	0.4	0.45
B	–0.35	–0.3	0.355	0.4	0.45
C	–0.3	–0.35	0.355	0.4	0.45
D	–0.3	0.4	–0.35	0.45	0.355

AQA

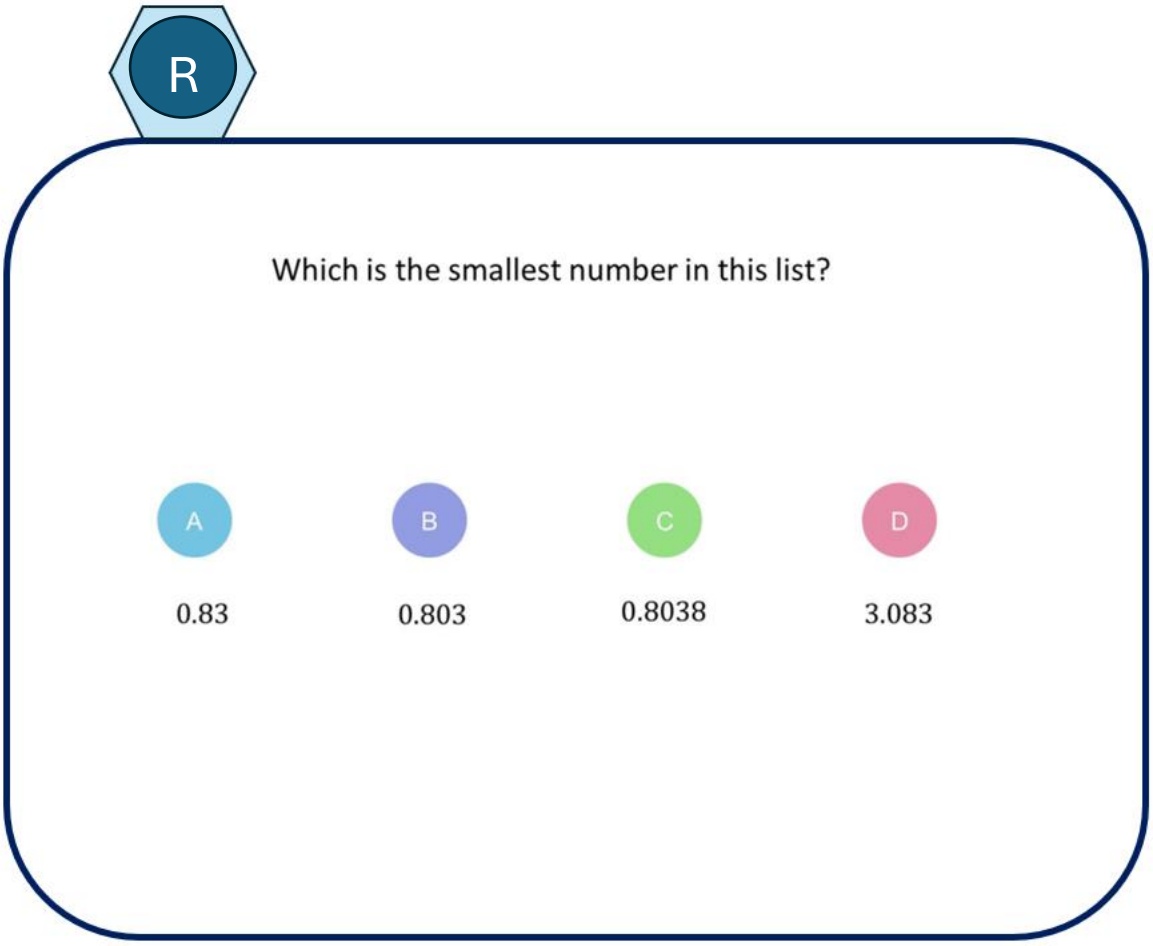
Put these numbers in order, starting with the smallest:

0.4 –0.35 0.45 –0.3 0.355

A	0.3	0.35	0.355	0.4	0.45
B	–0.35	–0.3	0.355	0.4	0.45
C	–0.3	–0.35	0.355	0.4	0.45
D	–0.3	0.4	–0.35	0.45	0.355

A	B	C	D
6 %	58 %	27 %	9 %

3-1-3_ Review (Dezimalzahlen)



****

Schemes Construction ... / Hook the word to ... History

****

The expression **"to decimate something"** comes from the **Latin word *decimare***, which means **"to take a tenth."** It originally referred to a **punishment used in the Roman army**: when a group of soldiers mutinied or showed cowardice, one in every ten men was **executed by lot**—a brutal form of discipline meant to restore order and morale.

Here's a quick breakdown:

- **Latin root**: *decimus* = "tenth"
- **Verb**: *decimare* = "to take or kill one in ten"
- **Historical use**: Roman military punishment
- **Modern use**: Now it means **to destroy a large part of something**—though it originally meant destroying **only 10%**.

So, over time, the meaning shifted from a very specific (and numerically precise) punishment to a more general expression of widespread destruction, like "The town was decimated by the hurricane."

****

Detect some misconceptions ...

****

****

Words matter ...

****

5,35

3,6

2,09

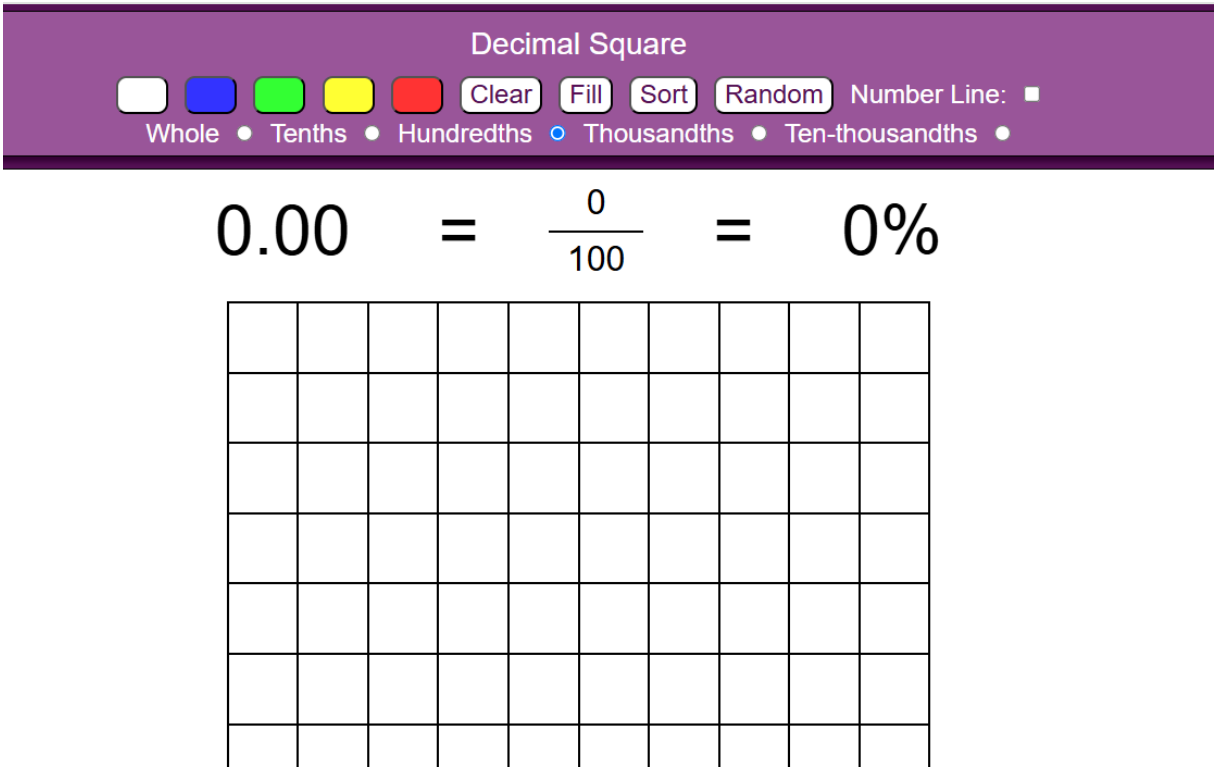
****

Visualization ...

****

Resources:

https://mathsbot.com/tools/decimalSquare



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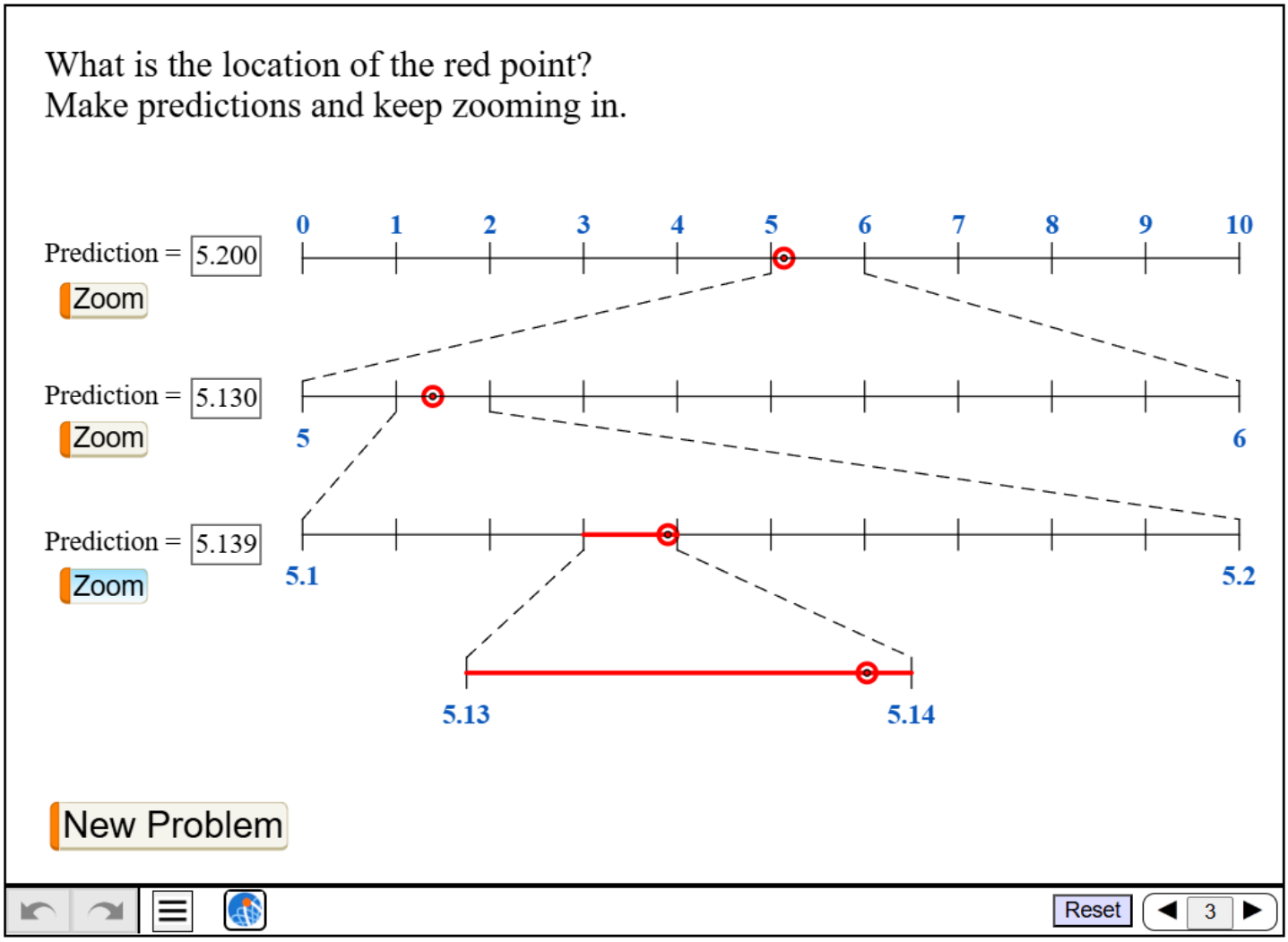
... more (visualization) ...

****

https://www.sineofthetimes.org/2018/zoom/



****

Deliberate Practice

****

https://donsteward.blogspot.com/2017/05/zoom.html?utm_source=podia&utm_medium=iframely

Fertige Übungsblätter ...

median
don steward
mathematics teaching 10 ~ 16

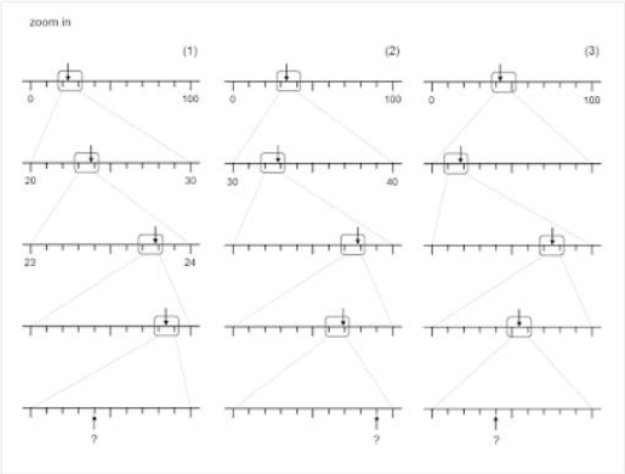
Monday, 22 May 2017

zoom

- place value, zooming in
- reversing the question
- generalising
- harder generalising

a powerpoint, kind of illustrating the zooming in and with the resources below

a far better, animated zoom from Daniel Scher



Pages

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- Don Steward's maths education resources
- Don Steward's presentations
- Don Steward's rough notes

images

you need to download the powerpoints for any animations to work
see the icon you need to find at the bottom of this column

topics

- 3D coordinates (1)
- 3D geometry (8)
- a add b squared (7)
- add/subtract simple (6)
- addition (9)
- addition simple (17)
- algebra (9)
- algebra misconceptions (2)
- algebraic fractions (3)
- angle bisector (5)
- angle proof (10)
- angles (16)
- angles in a triangle proof (1)
- angles in polygons (38)
- angles in quadrilaterals (8)

****

Push the limits ...

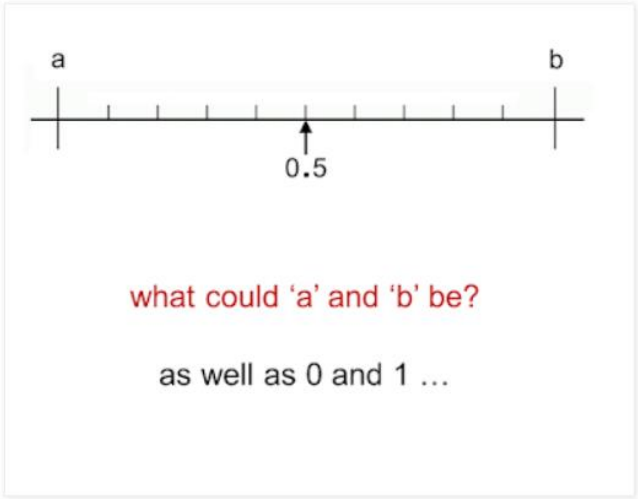
****

https://donsteward.blogspot.com/2015/12/decimal-scales.html?utm_source=podia&utm_medium=iframely

Thursday, 24 December 2015

decimal scales

an example of how reversing a question can be more interesting
leading, ideally, to generalising



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topics

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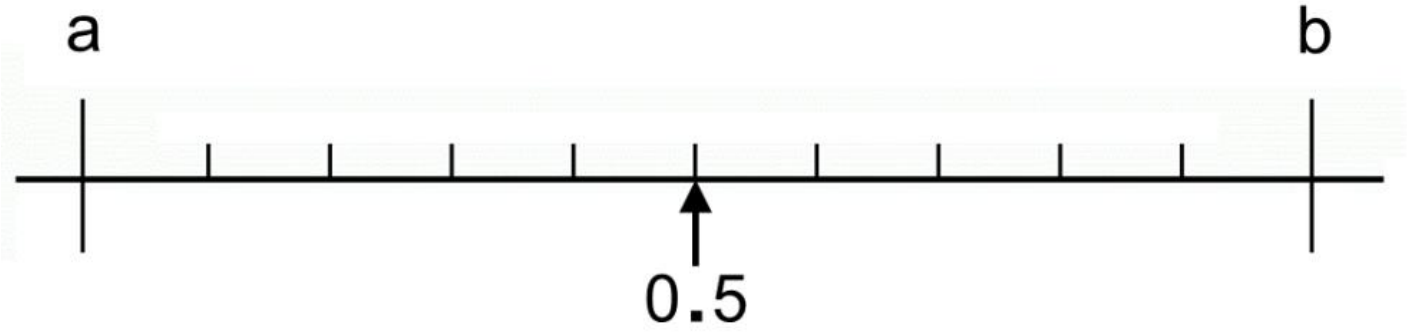
- algebra (9)
- algebra misconceptions (2)
- algebraic fractions (3)

****

Push **yourself** ...

****



what could ‘a’ and ‘b’ be?

as well as 0 and 1 …

****

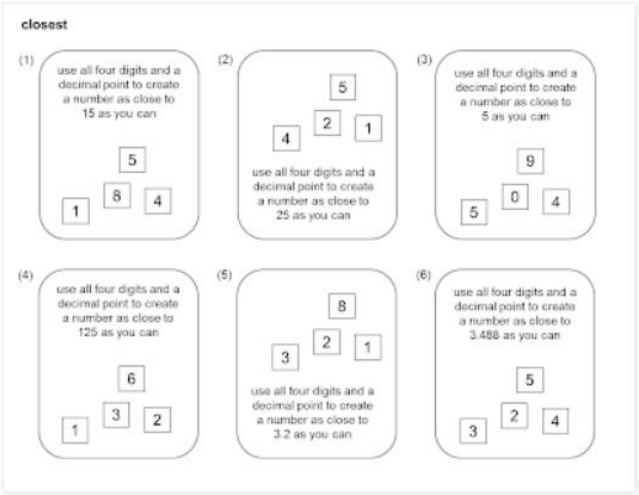
Overlearning

****

https://donsteward.blogspot.com/2013/12/nearest-to.html?utm_source=podia&utm_medium=iframely

Tuesday, 3 December 2013

nearest to



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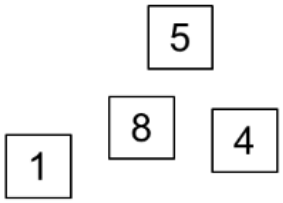
topics

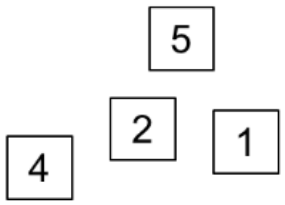
- 3D coordinates (1)
- 3D geometry (8)
- a add b squared (7)
- add/subtract simple (6)
- addition (9)
- addition simple (17)
- algebra (9)

closest

(1) use all four digits and a decimal point to create a number as close to 15 as you can

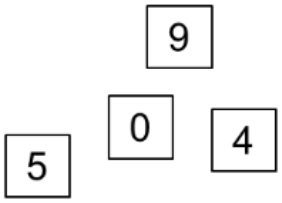


(2)

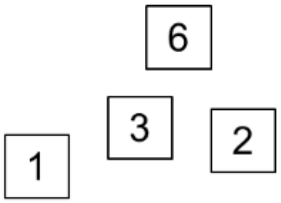


use all four digits and a decimal point to create a number as close to 25 as you can

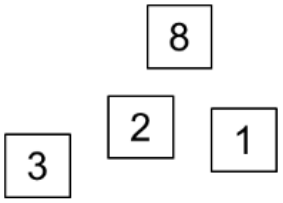
(3) use all four digits and a decimal point to create a number as close to 5 as you can



(4) use all four digits and a decimal point to create a number as close to 125 as you can

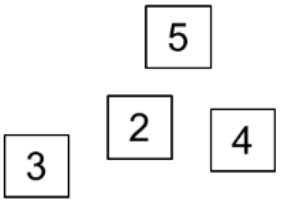


(5)



use all four digits and a decimal point to create a number as close to 3.2 as you can

(6) use all four digits and a decimal point to create a number as close to 3.488 as you can



****

Übung, Übung, ...

****

https://startingpointsmaths.com/2020/09/07/fraction-and-decimal-equivalents/?utm_source=podia&utm_medium=iframely

Fraction and Decimal Equivalents

Fraction and Decimal Equivalents

startingpointsmaths.com

Example 1

Write the decimal as a sum of fractions.

$$0.24 = \frac{2}{10} + \frac{4}{100}$$

Example 2

Write the sum of fractions as a decimal

$$\frac{4}{10} + \frac{7}{100} + \frac{2}{1000} = 0.472$$

1 Write the decimals as a sum of fractions.

(a) 0.1	(b) 0.01	(c) 0.6	(d) 0.07
(e) 0.12	(f) 0.31	(g) 0.60	(h) 0.001
(i) 0.143	(j) 0.301	(k) 1.437	(l) 7.057

2 Write the sum of fractions as a decimal.

(a) $\frac{3}{10}$	(b) $\frac{7}{100}$	(c) $\frac{1}{10} + \frac{3}{100}$	(d) $\frac{3}{10} + \frac{8}{100}$
(e) $\frac{7}{10} + \frac{9}{100}$	(f) $2 + \frac{5}{10} + \frac{8}{100}$	(g) $3 + \frac{1}{10} + \frac{4}{100}$	(h) $\frac{1}{1000}$
(i) $\frac{1}{10} + \frac{2}{100} + \frac{3}{1000}$	(j) $\frac{7}{10} + \frac{3}{1000}$	(k) $\frac{3}{100} + \frac{7}{1000}$	(l) $13 + \frac{9}{10} + \frac{7}{100} + \frac{5}{1000}$

3 For each diagram express the shaded region, as a sum of fractions and as a decimal.

Example

$$\frac{4}{10} + \frac{2}{100} = \frac{42}{100} = 0.42$$

(a) (b)

Download PDF Here

This task is focused on linking decimal place value with fraction meaning. Questions 3 and 4 play an important role. They are designed to convey why, for instance 4/10 + 3/100 is the same as 43/100.

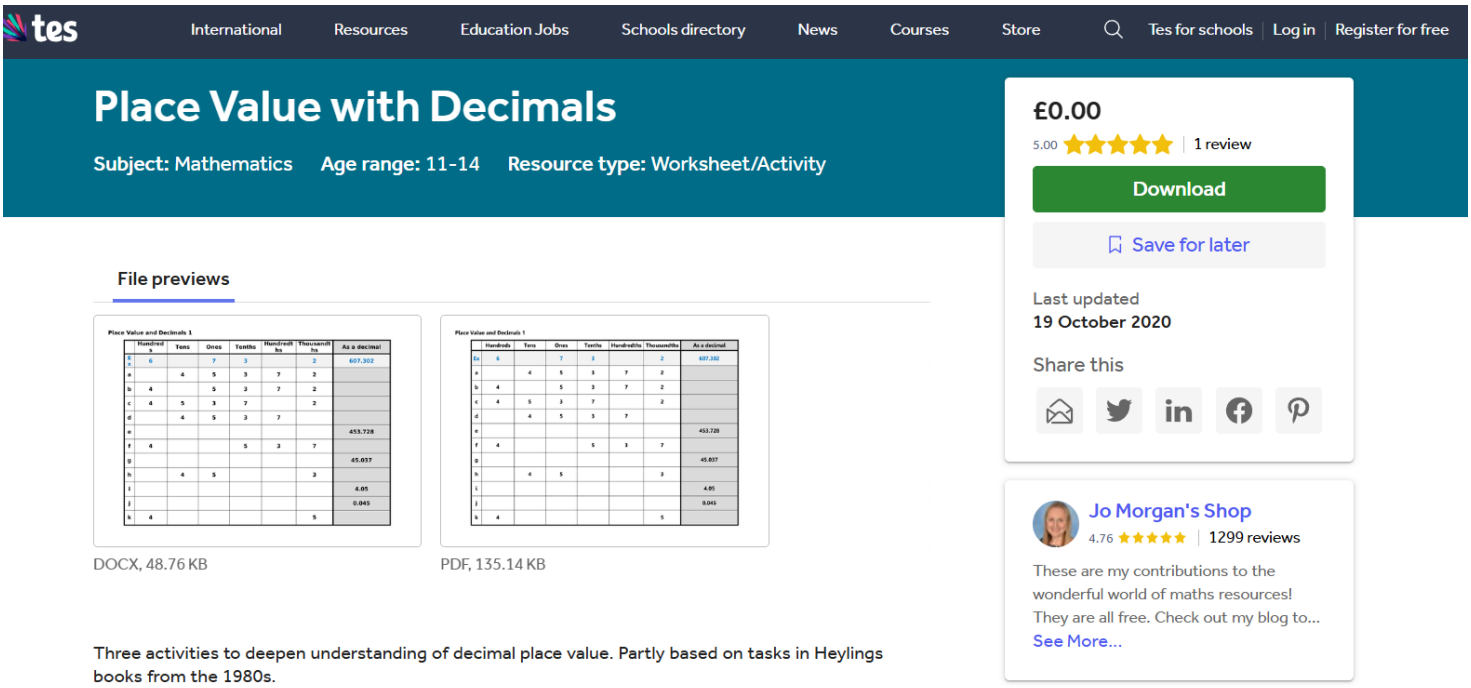
Credit: @chrismcgrane84

****

Übung, Übung, Übung …

****

https://www.tes.com/teaching-resource/place-value-with-decimals-12420353?utm_source=podia&utm_medium=iframely



https://www.tes.com/teaching-resources/shop/mrsmorgan1