

Getting Students to Ask the Right Questions The QFT Framework (A very brief introduction)

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Getting Students to Ask the Right Questions The QFT Framework (A very brief introduction)

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Overview

1. Introduction and overview
 2. Collaborative learning with the Question Formulation Technique (QFT)
 3. Curiosity as a motivator
 4. Examples of QFT in use
 5. Your observation about student learning
 6. Final reflection and finding out more
-

I. Introduction and Overview

What is question formulation?

Questions and Learning

Question Formulation (QF)

“Generating questions divergently and then working to improve them through convergent and metacognitive thinking”

Some Quotations

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place
For the first time

-T.S. Eliot

“Modern science is a technique... it is a practice that allows us to learn reliable things about the world. [Science] is a technique that was waiting for people to discover it.”

– Steven Weinberg
Nobel Laureate in Physics

“There is no learning without having to pose a question.”

- Richard Feynman
Nobel Laureate, Physics, 1965



Currently used by 300,000 teachers worldwide.



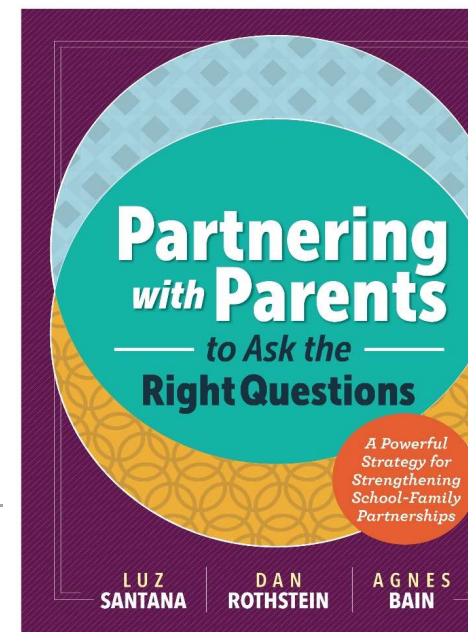
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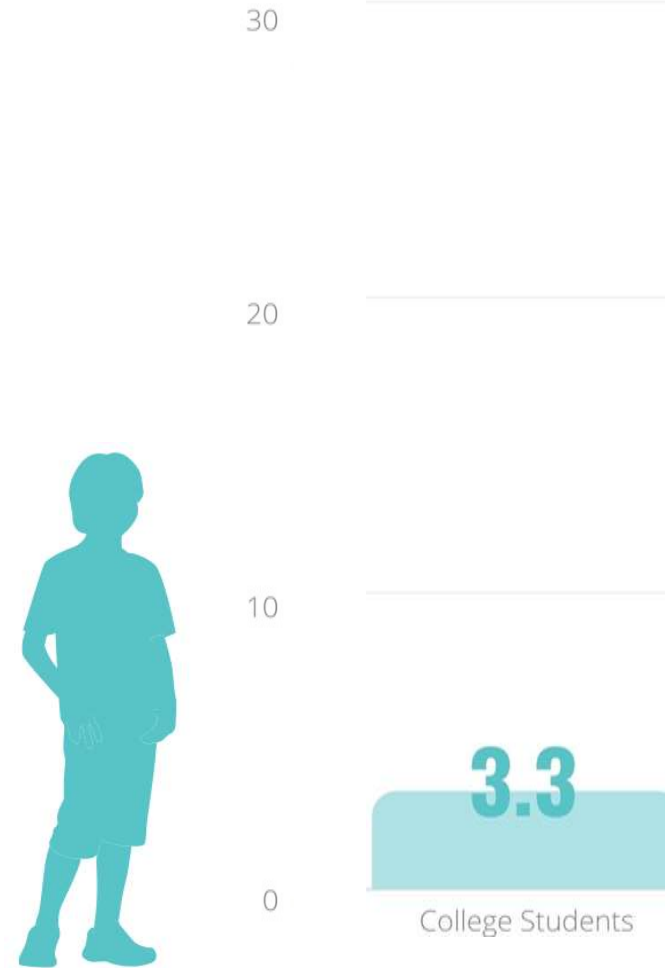
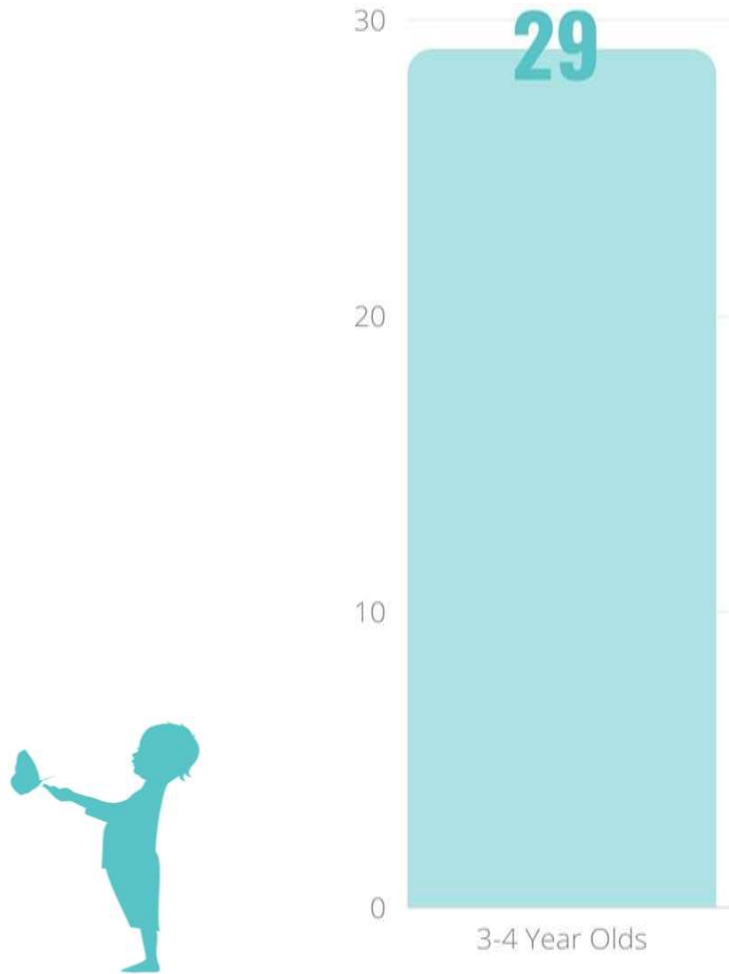
DAN
ROTHSTEIN

AGNES
BAIN



Why spend time teaching the skill of question formulation?

Question Asking Declines with Age



Tizard, B., Hughes, M., Carmichael, H., & Pinkerton, G.
Pearson, J.C. & West, R.

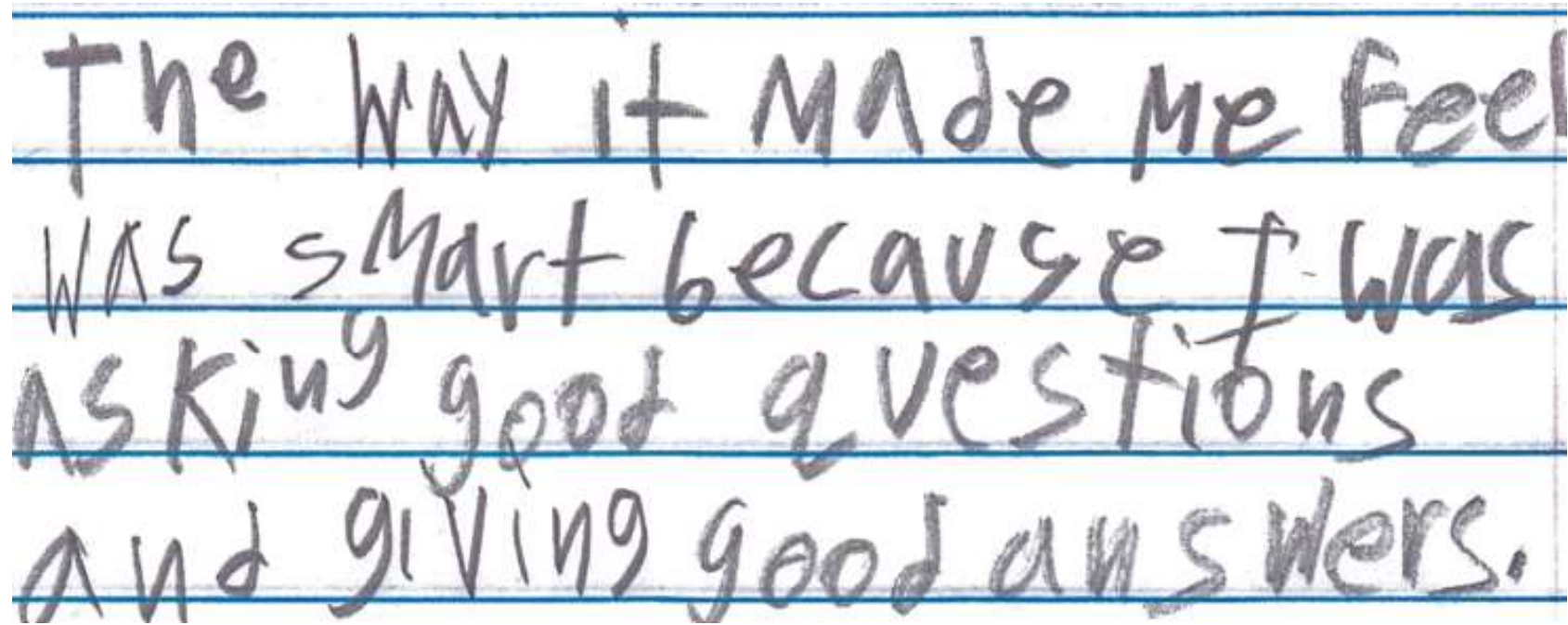
Research on the Importance of Questioning

Self-questioning (metacognitive strategy):

- Student formulation of their own questions is one of the most effective metacognitive strategies
- Engaging in pre-lesson self-questioning improved students rate of learning by nearly 50%

- John Hattie

Student Reflection



The way it made me feel
was smart because I was
asking good questions
and giving good answers.

“The way it made me feel was smart because I was asking good questions and giving good answers.”



Collaborative Learning with the Question Formulation Technique

The Question Formulation Technique (QFT)

Individuals learn to:

- **Produce** their own questions
- **Improve** their questions
- **Strategise** on how to use their questions
- **Reflect** on what they have learned and how they learned it

Rules for Producing Questions

1. Ask as many questions as you can
2. Do not stop to answer, judge, or discuss
3. Write down every question exactly as stated
4. Change any statements into questions

Produce Questions

1. Ask Questions

2. Follow the Rules

- Ask as many questions as you can.
- Do not stop to answer, judge, or discuss.
- Write down every question exactly as it was stated.
- Change any statements into questions.

3. Number the Questions

Question Focus

Students struggle to understand key concepts.

→ Now, ask questions. Number the questions. Follow the rules:

1. Ask as many questions as you can.
2. Don't stop to answer, judge, or discuss.
3. Write down every question exactly as it was stated.
4. Change any statements into questions.

Categorise Questions: Closed/ Open

Definitions:

- **Closed-ended** questions can be answered with a “yes” or “no” or with a **one-word** answer.
- **Open-ended** questions require more **explanation**.

Directions:

Identify your questions as closed-ended or open-ended by **marking them** with a “**C**” or an “**O.**”

Discuss

Closed-ended Questions

<p>Advantages</p>	
-------------------	--

Discuss

Open-ended Questions

<p>Advantages</p>	
-------------------	--

Change Questions

- Take one **closed-ended question** and change it into an **open-ended question**.



- Take one **open-ended question** and change it into a **closed-ended question**.



- Add these as new questions to your list

Prioritise Questions

Review your list of questions

- Choose the three questions you consider most important.
- While prioritising, think about QFocus, “*Students struggle to understand key concepts.*”

Prepare to share

- Why you chose those three questions?
- Where are your priority questions in the sequence of your entire list of questions?

Strategize and Action Plan

In order to answer your priority questions:

- What do you need to *know*? **Information**
- What do you need to *do*? **Tasks**

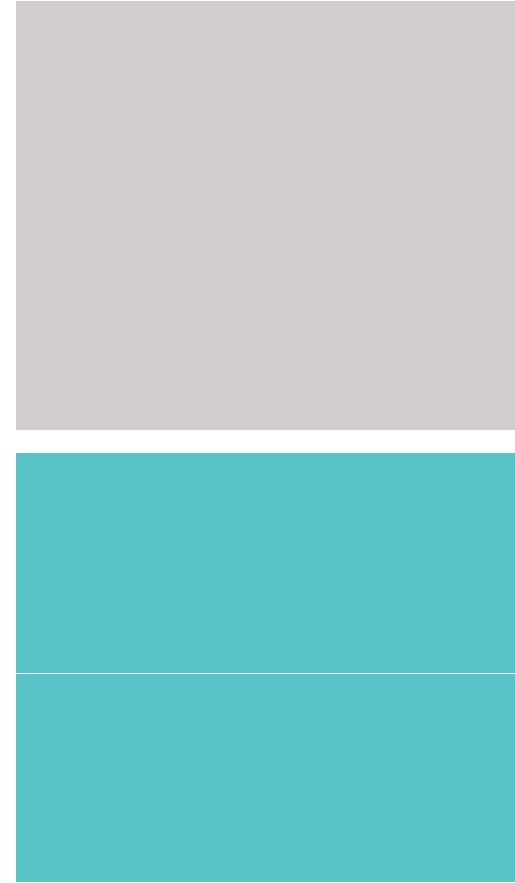
Information	Tasks

Share

- Priority questions
- The numbers where your prioritised questions appear on your list and the number of questions you generated
- Are there patterns?
- How can these question form your action plan

Reflect

- What did you learn?
- How did you learn it?



Unpacking the Question Formulation Technique

The QFT, on one slide...

1) Question Focus

2) Produce Your Questions

- ✓ Follow the rules
- ✓ Number your questions

3) Improve Your Questions

- ✓ Categorize questions as Closed or Open-ended
- ✓ Change questions from one type to another

4) Strategize

- ✓ Prioritize your questions
- ✓ Action plan or discuss next steps
- ✓ Share

5) Reflect

1. Ask as many questions as you can
2. Do not stop to discuss, judge or answer
3. Record *exactly* as stated
4. Change statements into questions

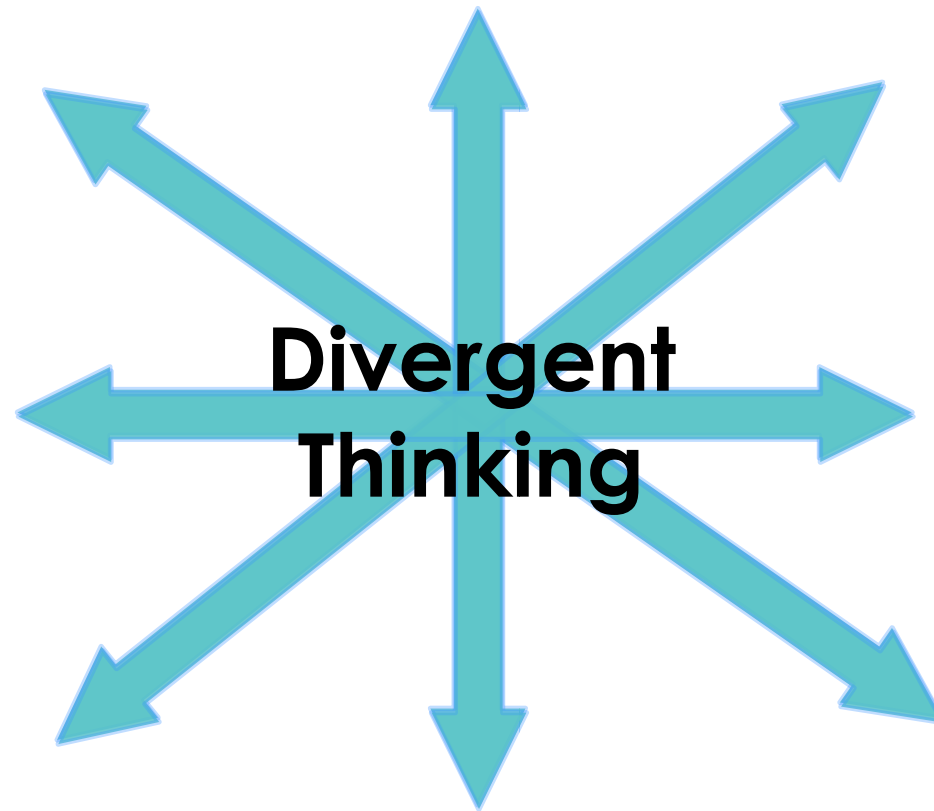
Closed-Ended:

Answered with “yes,” “no” or one word

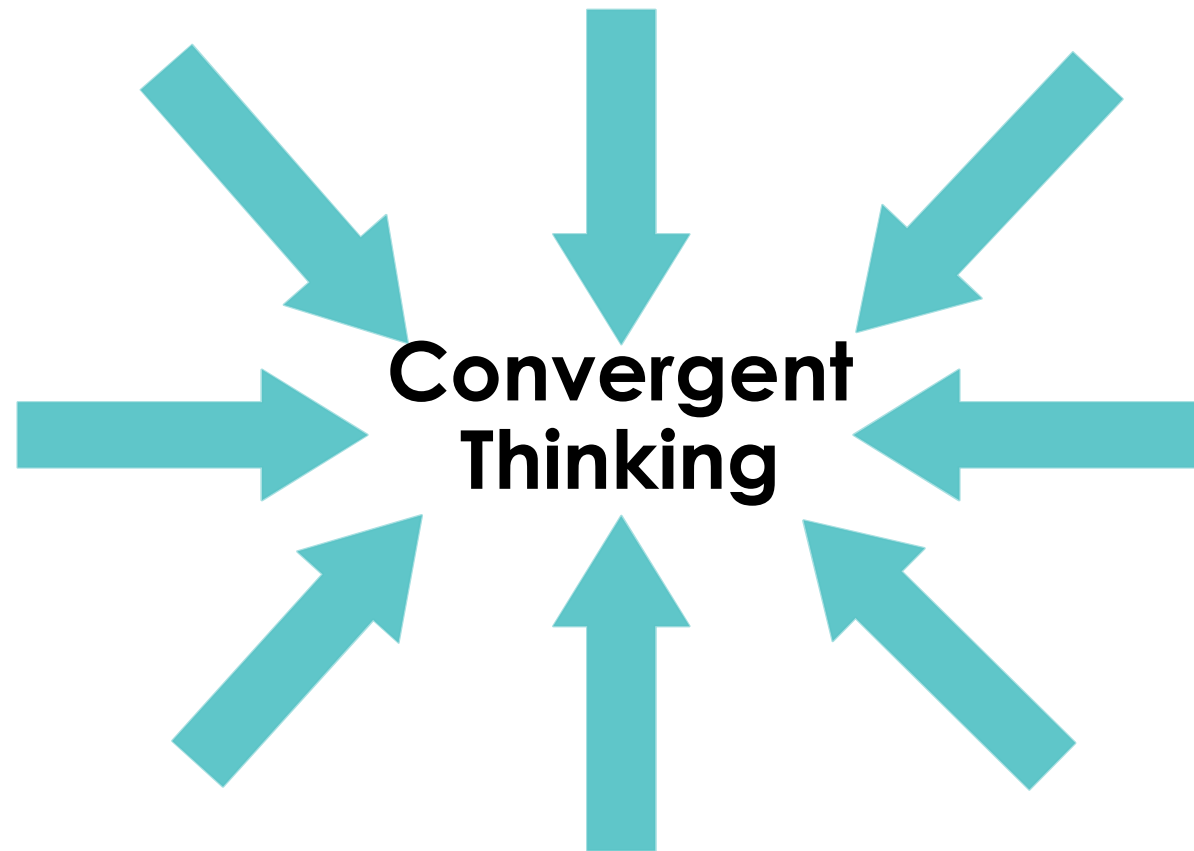
Open-Ended: Require longer explanation

Three thinking abilities, one strategy.

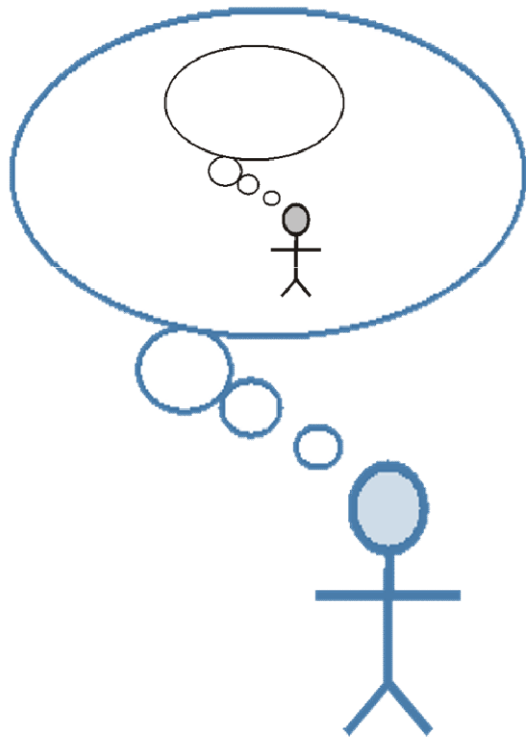
1) Thinking in many different directions



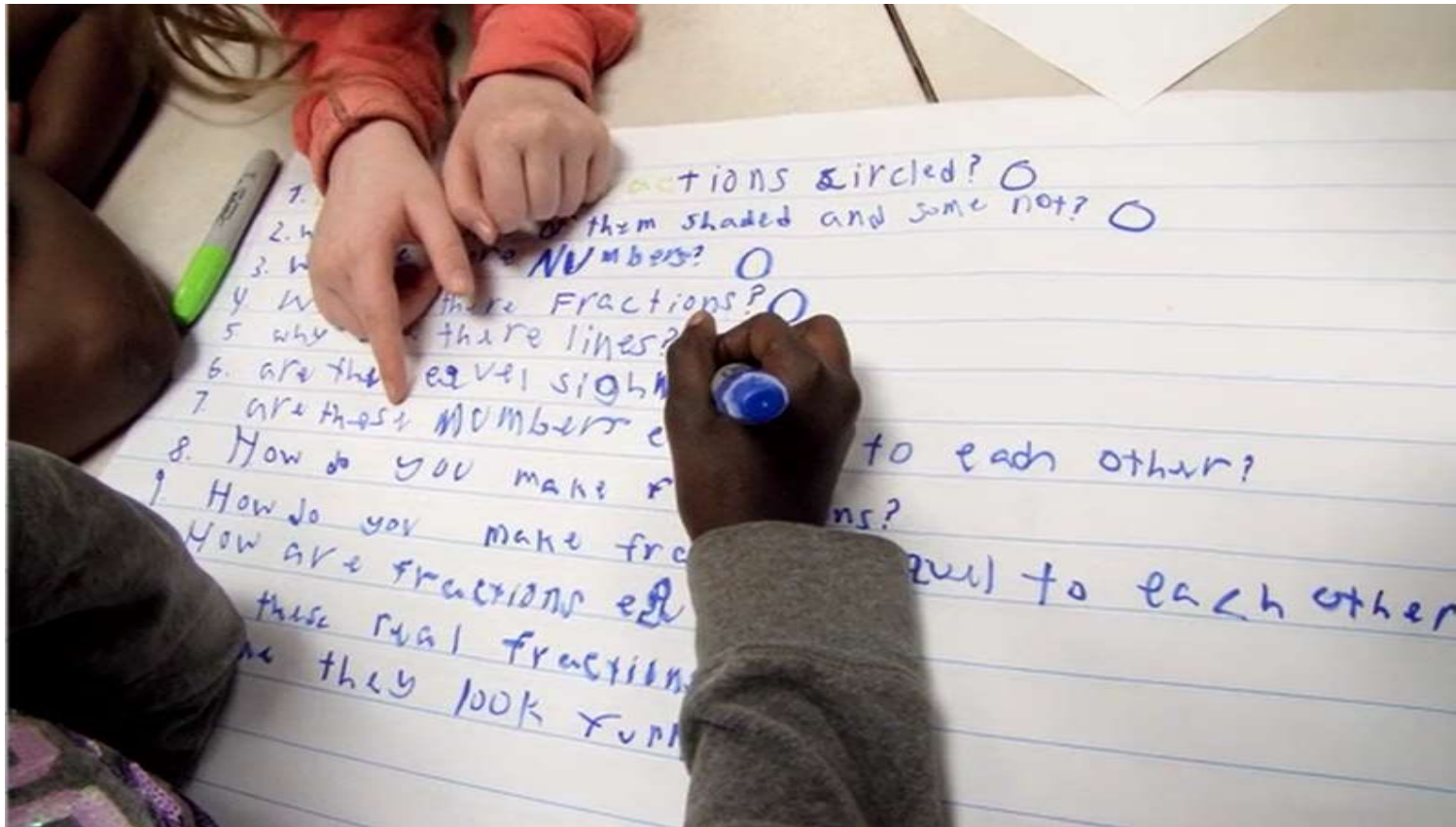
2) Narrowing down, focusing



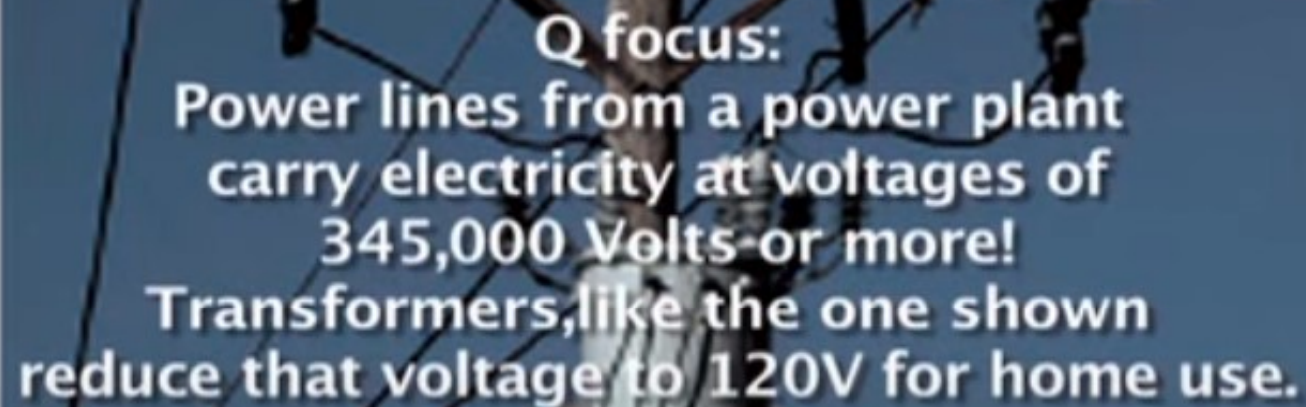
3) Thinking about thinking



Metacognition



Exploring Classroom Examples

The video frame shows a close-up of a power line transformer mounted on a wooden utility pole. The transformer is a large, cylindrical metal unit with several wires connected to it. The background is a clear blue sky. Overlaid on the image is white text that reads: "Q focus: Power lines from a power plant carry electricity at voltages of 345,000 Volts or more! Transformers, like the one shown reduce that voltage to 120V for home use." The text is centered and has a slight shadow effect.

Q focus:
Power lines from a power plant
carry electricity at voltages of
345,000 Volts or more!
Transformers, like the one shown
reduce that voltage to 120V for home use.



1:23 / 10:26

• Review the rules for producing questions Ask as many qu...



The Question Formulation Technique in a High School Science Class

30,636 views Mar 14, 2016...more

<https://www.youtube.com/watch?v=9wrIIDNECUQ>

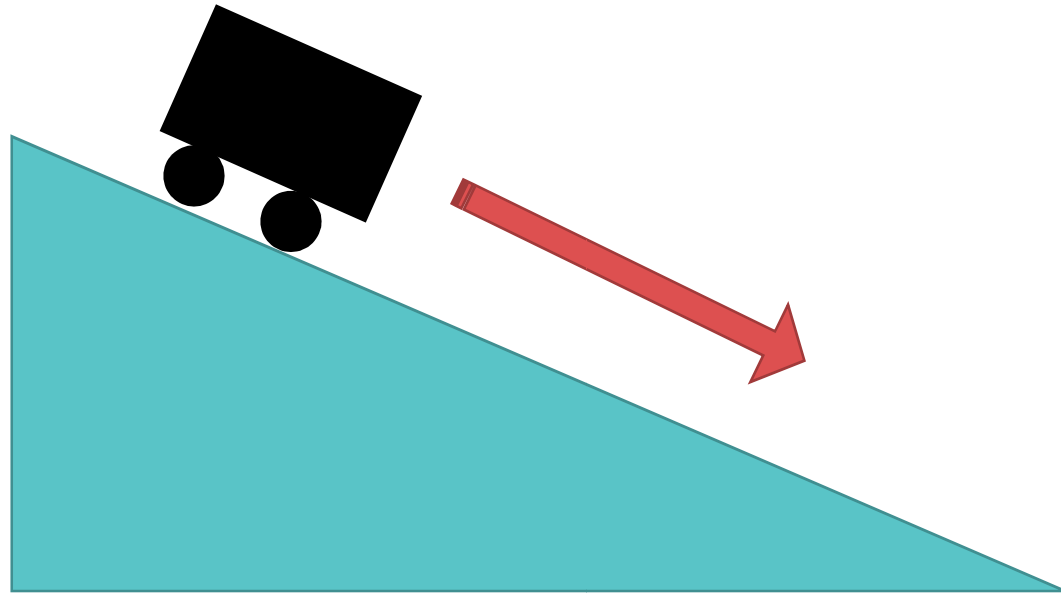
Question Focus (QFocus):

A stimulus or prompt for student questions

- A phrase or quotation
- An image or video
- A primary source
- A podcast or speech
- A hands-on experience or experiment
- An equation or data set
- Some combination of the above

The QFocus is ***not*** a question!

Question Focus (Image)



Motion on an incline

Student Questions

How steep is the incline?

How would the angle of the incline affect the motion of the cart?

How does the weight of the cart affect it going up the ramp?

How do the size of the wheels affect the cart?

How does the incline affect the acceleration of gravity?

How much friction does the cart have?

How much momentum does the cart have?

How long is the ramp?

How tall is the ramp?

0. Does the shape of the cart matter?

1. Do the magnets work?

12. What is the maximum speed of the cart?

13. What forces are affecting the cart?

14. How much force is required to push cart off the ramp?

15. Is the ramp linear?

16. What is the width of the cart?

17. How does the mass of the cart affect the motion of the cart?

18. What is the initial velocity of the cart?

19. What is the final velocity of the cart?

Next Steps with Student Questions

- Students categorized their questions into topics using color-coding.
- Within those categories, students' identified a "lead question" and the questions they'd have to answer first to get at the lead question.
- Students then prioritized with the instructions, "If you were to design a lab, which question would you design a lab around, and why?"
- Students turned the lead question they chose into a "purpose statement". This became their hypothesis to test in the lab.

Priority Question

- How does the mass of the cart affect the acceleration of the cart?

Next Steps with Student Questions

Groups chose similar questions, either: How does the mass of the cart affect the motion? Or, how does the angle of incline affect the motion?

Groups identified dependent variable(s), independent variable(s), and the set up for their experiment, all groups using the same materials.

Students experimented and collected data.

Students presented their initial questions, design process, and Lab results.

Q2: How does the mass of the cart affect the acceleration of the cart?

Independent Variable: Mass of the cart (kg)
Dependent Variable: Acceleration (cm/s^2)

To Find V_f :
 $V_f = V_i + at$
 $V_i = 0$
 $a = ?$
 $t = \text{TBD}$

Diagram of a cart on an incline with labels:
- Direction
- $V_i = 0$
- Δx
- Displacement will be positive
- acceleration will be positive
- Start at 30 cm

Equations:
 $C = \frac{1}{2}at^2$
 $b = V_i$
 $a = \text{Starting point (0m)}$

Table: Time (s)
Start at 30 cm
T1 T2 T3

Materials:
- Ramp
- pole holding ramp (ring stand)
- cart
- cart stopper
- Logger pro hearing device / cap/s
- computer
- weights
- motion detector

* How will we accurately stop the cart at the bottom? (Do we see it hit?)

* We will only look at the graph and data from 30cm - 170cm from the graph at Logger pro
Start at 30cm so motion detector can get best read.

* We would only measure the weight, time & displacement would always be the same each time. From we could calculate the final for each mass.

Question Focus

Bias in Science

Student Questions

- What are some occurrences?
- What topics in science have most bias?
- How is bias defined?
- Are there different types of biases in science?
- How does bias affect experiments and results?
- How does bias influence data collection?
- Is it possible to be completely bias free?
- How to reduce bias?
- Why is there bias?
- 0. Is bias intrinsic?
- 1. Is bias necessarily bad?
- 12. How important is the fact that there is bias? (O)→ Is it important that there is bias? (C)
- 13. When in history did bias in results of experiments affect the public?
- 14. How do you quantify bias?
- 15. What increases/decreases bias?
- 16. What is the trend of bias in science? More? Less?
- 17. Are certain groups of people more easily biased? (C)→ What are the certain groups of people? (O)
- 18. How can we eliminate bias in high school experiments w/o high tech?
- 19. What's in place now to reduce bias?

Next Steps with Students' Questions

- Students identified patterns that emerged from their questions
- They categorized their questions into those patterns
- Students priority questions were used as a class discussion activity

Students' Categorization

History/definition

How is bias defined?

Why is there bias?

Is bias intrinsic?

Is bias necessarily bad?

When in history did bias in results of experiments affect the public?

How do you quantify bias?

Examples

What are some occurrences?

What topics in science have most bias?

Are there different types of bias in science?

Impact

- How does bias affect experiments and results?
- How does bias affect influence data collection?

Help/reduce

- Is it possible to be completely bias free?
- How do you reduce bias?
- What increases/decreases bias?
- How can we eliminate bias in high school experiments w/o high tech?
- What's in place now to reduce bias?

Patterns/trends

- What is the trend of bias in science? More? Less?
- Are certain groups of people more easily biased? (C) → What are the certain groups of people? (O)

1. What do you observe when your students are fully **engaged**?

2. What do you observe when your students demonstrate **comprehension**?

3. What do you observe when your students **discover** something new?



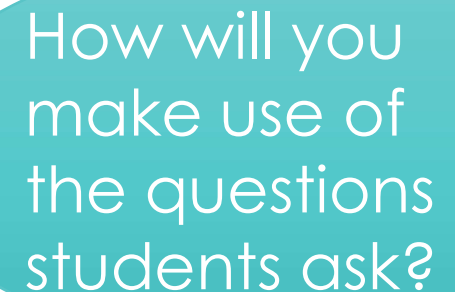
The Basics of QFT Lesson Planning

Various Teaching Purposes

- Engagement
- Research
- Formative assessment
- Summative assessment
- Peer review
- Skill development
- Problem-solving



Is the QFT the right tool for your objective?



How will you make use of the questions students ask?

Next Steps?

Pop Quiz or Reading
Check

Debate Prep

Paper topic

Lab work & Experiments

Exit ticket or "Do Now"

Hang on walls,
Check Off as Answered

Research

Projects

Test Prep

Presentati

Class discussion prom

Socratic Seminar Promp

And sometimes...

Nothing!

Interview an Expert

Journal Prompt

Guest speakers

Close Reading Protocol

Year-long or Unit-long
Essential Questions

Tailoring Instruction

Service Action Projects

Question Focus (QFocus):

A stimulus or prompt for student questions

- A phrase or quotation
- An image or video
- A primary source
- A podcast or speech
- A hands-on experience or experiment
- An equation or data set
- Some combination of the above

The QFocus is ***not*** a question!

Designing a Question Focus

An effective QFocus is:

1. Directly tied to lesson's main idea or objective
2. Simple...but not too simple
3. Interesting or provocative to students...but not biased or leading

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place
For the first time

-T.S. Eliot

Final Reflection

1. What is one important thing you learned today?
2. What would you tell your colleagues about the Question Formulation Technique?

Acknowledgments

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**Thank you for your attention and
participation**



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