



Building Student Understanding through Effective Questioning

**Presented by
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***To question well is to teach well.
In the skillful use of questions,
more than anything else,
lies the fine art of teaching.***



Ernst Sachs

What are the purposes of teachers' classroom questions?

- * To develop interest and motivate students to become actively involved in lessons**
- * To evaluate students' preparation and check on homework or seatwork completion**
- * To develop critical thinking skills and inquiring attitudes**
- * To review and summarize previous lessons**
- * To nurture insights by exposing new relationships**



Mathematical Process Standards

1. **Apply mathematics to problems** arising in everyday life, society and the workplace.
2. Use problem solving model that incorporates **analyzing** given information, **formulating** a plan or strategy, **determining** a solution, **justifying** the solution and **evaluating** the problem solving process.
3. **Select tools** such as real objects, manipulative, paper pencil and technology or techniques such as mental math, estimation and number sense to problems.
4. **Communicate mathematical ideas, reasoning** and their implications using symbols, diagrams, graphs and language.
5. **Create and use representations** to recognize, record and communicate mathematical ideas.
6. **Analyze** mathematical relationships to connect and communicate mathematical ideas.
7. **Display, explain or justify mathematical ideas** or arguments using **precise mathematical language** in written and oral communications.

What are the results of good questioning during teaching?

- **Helps students to participate actively in lessons**
- **Provides an opportunity for students to express their ideas and thoughts**
- **Allows students to hear divergent opinions from peers.**
- **Draws attention and highlights important points in the lesson**
- **Helps develop confidence and feelings of success in students, leading them beyond the conventional patterns of thinking**

Research shows classroom teachers spend anywhere from 35% to 50% of their instructional time conducting questioning sessions.

Kathleen Cotton. "Classroom Questioning."
North West Regional Educational Laboratory.

**What is the BEST question
you have asked in your
classroom?**



The Art of Questioning in Mathematics

NCTM Professional Standards



The Art of Questioning in Mathematics

NCTM Professional Standards

Help students work together to make sense of mathematics

Help students rely more on themselves to determine whether something is mathematically correct

Help students learn to reason mathematically

Help students learn to conjecture, invent, and solve problems

Help students to connect mathematics, its ideas, and its applications

What Types of Questions do we ask?

1. Factual questions are used to get information from the students and often test rote memory.
Example: “What is ____?”

2. Clarification questions intend to provide clarity to both students and teachers. Such questions have important clueing effects and help students to revisit their earlier statements with alternative perspectives.
Example: “What do you mean by ..?” “Can you give me an example?” “Can you rephrase what you have just said?”

Types of Questions

3. Broadening / Extension questions

can be useful in opening up further possibilities. Such questions can be used to assess additional knowledge of the students.

Example: “Do you know any other situation where this can be applied?”

4. Justifying questions probe for assumptions and explore reasons for particular answers. These questions require significant comprehension and reasoning skills on the part of the students.

Example: “You mentioned _____. What are your reasons?”

Types of Questions

5. Hypothetical questions are used to explore students' understanding of complex situations beyond the scope of a particular encounter by creating hypothetical scenarios.

Example: "Suppose this happened. How would you revise or rearrange ____?"

6. Questions about questions probe for reasons for the question that students ask other students or teachers.

Example: "You asked _____. Why did you ask that particular question? What are you thinking of?"



Video: Types of Questions



Factual	Justifying
Clarification	Hypothetical
Broadening/Extension	Questions about Questions

During questioning

Use less of:

What

When

Where

Who

Which

Use more of:

Why

How

Suppose

Justify

Defend

Elaborate

Bloom's Taxonomy Asking Good Questions

Creating: can the student create new product or point of view?

Evaluating: can the student justify a stand or decision?

Analyzing: can the student distinguish between the different parts?

Applying: can the student use the information in a new way?

Understanding: can the student explain ideas or concepts?

Remembering: can the student recall or remember the information?



While questions which elicit lower level thinking are an important part of teaching, they are useless unless they build toward questions which help kids develop higher order thinking skills.

Benjamin Bloom

STAAR Grade 3

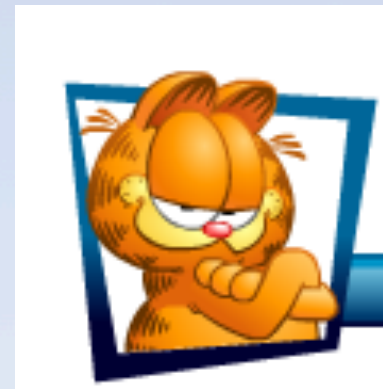
Mr. Garza has three kinds of animals on his farm. He has 6 dogs. He has twice as many cows as dogs. He has 3 times as many sheep as cows. How many sheep does Mr. Garza have on his farm?



Wait Time

**Some call it laziness.
I call it deep thought.**

Garfield



What are the Benefits of Silence?

For the students

- More meaningful answers
- Improved accuracy
- Improved length
- Fewer 'no answers'



For the teachers

- Higher order questions
- Precise formulation of questions
- Varied and flexible questions
- Convey teachers' attentiveness

What can we ask when students fail to answer any question?



- Is the question clear to you?
- Do you want me to rephrase the question?
- Which part of the question did you not understand?
- Is the question too difficult for you?

What should teachers do when a student's response is incorrect?

- **Provide the opportunity for revisions by not responding immediately, thus allowing the student time to come up with another answer.**
- **Ask subsequent questions in a manner that contains clues to the first question leading the student to the correct answer.**

What should teachers do when a student's response is incorrect?

- **Re-frame the question so that the wrong answer becomes correct.**
- **Treat the wrong answer as plausible but in need of further elaboration and consideration.**
- **Declare perplexity over the response, i.e. "Tell us more."**

Question Cycle

Ask the question



Period of silence



(No response



Simplify the question)



Students answer



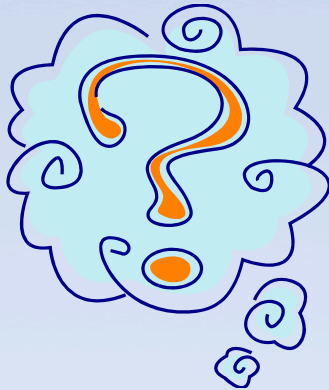
Period of silence



Discuss the answer

A prudent question is one-half of wisdom.

Francis Bacon



**Productive
Talk
Moves**

1. Revoicing

“So you’re saying that it’s an odd number?”

2. Restate someone else’s reasoning

“Can you repeat what Joe just said in your own words?”

3. Apply their own reasoning to someone else’s reasoning.

“Do you agree or disagree? Why?”

4. Prompt students for further participation

“Would someone like to add on?”

5. Use Wait Time

“Take your time. We’ll wait”



Strategically timing when to ask specific questions

Before beginning a new unit: discover and honor what students already know and to create excitement about what is coming next.

During learning: encourage students to engage with one another, which can lead to more questions

End of a class period: help students synthesize what they have learned

The Curious Classroom: Answers About Questions

Catherine Rubin

Teaching Children Mathematics

Focus Issue: The Value of “WHY?”

**Bees have 4 wings, and flies have 2 wings.
There are some bees and some flies in a
room. There are 24 wings in all. How
many bees and flies could there be?**

**Do you have all the combinations?
How do you know?**



FIGURE 1

(a)



(b)



I count by 2s

FIGURE 2



FIGURE 2

(b)



There are 5 bees
and 2 flies.

No, because there could be more
flies or more bees.

FIGURE 3

(a)

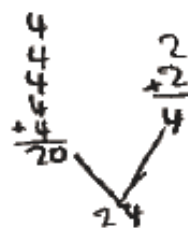
8 flies and 2 bees
~~flies wings~~
 6 flies & bees
 $12 + 12 = 24$

Reduce flies
 by 2 and add 1 bee

(b)

5 bees

2 flies



Yes

6 bees
 if 5 bees
 4 bees
 ↑ 3 bees
 2 bees
 1 bee

0 flies
 2 flies
 4 flies ↓ + 2
 6 flies
 8 flies
 10 flies

STAAR Grade 4

Maricella buys 75 tickets at a carnival. She keeps 35 tickets for herself and gives the remaining tickets to her 2 sisters. If each of Maricella's sisters gets the same number of tickets, how many tickets does each sister get?



Open Questions

The answer is 5. What is the question?

Why is 0 a special number?

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1860 edition of Barnard's
American Journal of Instruction

