Determining What Students Know

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[Title]
Determining What Students Know

[Description]
To be effective, you need to focus on what the student doesn't already know. Learn techniques to gauge existing student knowledge so that you can personalize their learning.

[Learning Objectives]

- Explain how to effectively determine what students know by assessing prior knowledge and asking guiding questions
- Identify features of effective responses to support students
- Apply strategies to determine if students have the necessary prior knowledge to solve a math problem

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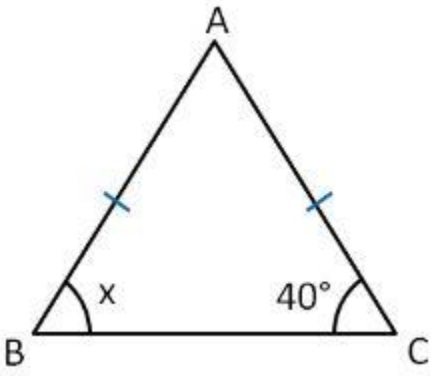
Tutor's Experience Level:
How would you describe your tutoring experience and skills?
Beginner tutor- 1 (no experience)
Expert tutor- 5

Scenario 1:
You are working with a student named Cindy on her math homework. She is having trouble solving a geometry problem dealing with triangles. She shows you the following diagram displaying a triangle and states that she has to determine the value of angle *x* (shown right). Cindy says, "I don't know what to do."



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[Predict/Decide - Open Response]
1. What exactly would you say to Cindy to begin helping her solve the math problem?

[Predict/Decide - MCQ]
2. Which of the following tutor's responses below do you think is the most effective tutor response in helping Cindy?

A. “Cindy, this is an isosceles triangle which has two congruent sides and angles. Given this hint, can you solve the problem now?”
B. “To begin, what type of triangle is this? This information will be very helpful in solving the problem. ”
C. “Let’s talk about how to begin, Cindy. What do you know about the triangle?”
D. “So, you start. What do you think is the answer? How many degrees is angle x?”

[Explain- Open]
3. Why do you think the tutor’s response you selected in (2) will best support Cindy in solving the math problem?

[Explain- MCQ)
4. Which of the following statements aligns with the rationale you chose and explained in (2) and (3).

A. By asking the student how they want to begin and asking them what they know, tutors can determine what the student already knows, or assess prior knowledge.
B. Asking a student a question about the problem, such as the type of triangle, will give the student useful information. Tutors should always help students find key information to solve the problem.
C. By giving a student the information they need to solve the math problem, they will get the answer correct quickly. When students solve problems quickly they gain confidence.
D. By having the student attempt to solve the problem in the beginning, tutors can see where the student is wrong and then correct them.

[Observe] - (Give desired, recommended response, according to research with explanation)
Research Recommendations
Studies have shown that when a tutor begins a session, it is important they understand what the student already knows and can “learn what students know”. Research states a tutor should begin the session by having a student explain what they know. In addition, it is important for tutors to not make assumptions about students' knowledge and assume students have knowledge of concepts that they may not know. For this reason on Question (2), Option C is the most desired response or correct answer.

> “Let’s talk about how to begin, Cindy. What do you know about the triangle?”

Research demonstrates that by determining what a student knows, a tutor can leverage student responses to efficiently gauge their level of understanding at the start of the session and use this as a launching point for the rest of the session. In addition, asking a student to explain what they already know will also uncover misconceptions they have so that tutors can correct them. Lastly, a tutor should ask questions and offer support as a student attempts the problem

themselves. This effortful learning is called *productive struggle*. It's important to empower a student to find the answer themselves based on their prior knowledge and logic before teaching them a concept explicitly. To summarize, researchers suggest a tutor should:

- Assess a student's prior knowledge.
- Guide the conversation to catch student's misconceptions or errors.
- Support productive struggle.

(YUP, 2021)

[Explain- Open]
5. In your own words, please explain why it is important for a tutor to determine what a student already knows before helping a student solve a problem?

6. How much do you agree or disagree that it is important for a tutor to determine what a student already knows before helping a student solve a problem?

Strongly disagree-1
Somewhat disagree-2
No opinion-3
Somewhat agree-4
Strongly agree-5

7. Explain why you agree or disagree.

[Explain- Multiple Choice]
8. You continue as Cindy's tutor in helping her solve the same math problem discussed previously. You say to Cindy, "Tell me how you want to begin, Cindy. What do you know about the triangle?" Cindy replies, "I know one of the angles is 40°." You reply, "Good, do you know anything else?". Cindy says, "I know two sides are the same length." You say, "If two sides of a triangle are the same length, what does that say about their corresponding angles?" Cindy says, "They are the same too." You say, "That is correct. So what is the measure of angle x?"

As Cindy's tutor, what strategy are you using to lead Cindy to the correct answer on her own?

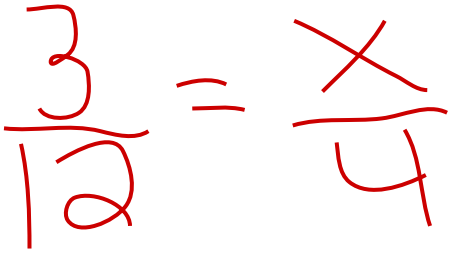
A. **Productive struggle**
B. Constructive feedback
C. Praise
D. Baseline knowledge

Research Recommendation
Studies show encouraging students to actively discuss their thoughts encourages active learning. Tutors should support students through “productive struggle”, or effortful learning that empowers students to attempt solving new math problems using logic and prior knowledge, before explicitly being taught a concept. For this reason, the correct answer to (8) is A. Productive struggle.

Tutors can respond to students to support productive struggle by saying, ‘Tell me what you mean’, ‘Talk about it some more’ or the insistence of sense-making with ‘Why is that?’. These responses by tutores provide opportunities for students to elaborate on what they understand to clarify the source of their struggles.

(YUP, 2021)

Scenario 2:
You are tutoring a student named Roberto. He shows you a math problem from his homework involving equivalent fractions. He writes the following problem and then states, “I do not know what to do.”



[Predict - Open Response]
9. What exactly would you say to Roberto to begin helping him solve the math problem?

[Predict - MCQ]
10. With respect to Roberto, which of the following tutor’s responses below do you think effectively begins the lesson?

I would say to the student:

A. “Roberto, what do you think is the coefficient of x in this problem?
B. **“Roberto upon looking at this problem, what do you know ?**
C. “Roberto, you can try to simplify the fraction on the left first. Great. What do you think you should do next?”
D. “Roberto, you need to use this rule - if you multiply both sides with the same number, the two sides remain equal. Do you know what to do now?”

[Explain- Open Response]
11. Why do you think the approach you selected in (10) will best support Roberto in solving the math problem?

[Explain- MCQ]
12. Why do you think the approach you selected in (10) will best support Roberto in solving the math problem -- which of the following is the best explanation for this approach?

A. Tutors should give students the information they need to solve a problem, such as how to simplify fractions, at the beginning of a lesson to ensure a student does not struggle.
B. By having students attempt to solve the problem at the beginning, tutors can find where the students are making an error and immediately tell them they are wrong.
C. When a tutor asks a student to explain how they began a problem, it helps them determine what a student already knows to guide them in their learning.
D. Most students are short on time. It is important that a tutor gives the correct answer quickly. This will ensure students are successful.

Conclusion

Experts believe that the best approach on Question (10) is Option B:

"Roberto, upon looking at this problem, what do you know?"

This approach assesses his prior knowledge by asking him to explain how he began solving the problem and what he thinks his next steps should be. In addition, asking Roberto to explain his thoughts on solving the problem is a good way for a tutor to guide the conversation to catch Roberto's misconceptions and to know where to take the rest of the session.

Feedback

Indicate how much you agree or disagree with the following statements:

This module helped me determine what students know and assess their prior knowledge.
Strongly disagree-1
Somewhat disagree-2
No opinion-3
Somewhat agree-4
Strongly agree-5

This module helped me identify features of effective responses to support students.
Strongly disagree-1
Somewhat disagree-2
No opinion-3
Somewhat agree-4
Strongly agree-5

This module helped me apply strategies for effectively responding to students.
Strongly disagree-1
Somewhat disagree-2
No opinion-3

Somewhat agree-4
Strongly agree-5

This module was valuable.
Strongly disagree-1
Somewhat disagree-2
No opinion-3
Somewhat agree-4
Strongly agree-5

I can apply what I learned from this module to my mentoring with students.
Strongly disagree-1
Somewhat disagree-2
No opinion-3
Somewhat agree-4
Strongly agree-5

Please provide any feedback or comments related to this training module.

For more information regarding how to master math content by assessing prior knowledge, check out the resources below:
Importance of Building on Prior Knowledge
How to Promote Productive Struggle in Math
Yup's Teaching Framework

References:

NCTM. (2021). National Council for Teachers of Mathematics Effective Teaching Practices.

Yup Blog. (2021). The Importance of Building on Students' Prior Knowledge. Math Learning. Retrieved on March 22, 2022 from https://yup.com/blog/importance-building-on-prior-knowledge/

Yup's Teaching Framework. (2021). Yup's Teaching Framework. https://yup.com/downloads/Yup_Teaching_Framework.pd