

What role does teacher questioning play in learning mathematics?

Research and Best Practice



Learning is maximized in classrooms where questions are encouraged, elaboration and explanation are expected, and feedback is frequent. In such classrooms, both large and small group discussions are prevalent, with interaction between teacher and students and among students.

Effective mathematics teachers (those who are highly rated by their students and whose students perform well on both content and problem-solving skills assessments) ask many questions of all types during their lessons. Compared to less effective teachers, they pose more questions with higher cognitive demand, and ask more follow-up questions. Their students ask more questions, as well. Effective teachers orchestrate productive discussion in classrooms. Students engaged in discussion are better able to make sense of ideas, create as well as demonstrate understanding, and reflect on their thinking. Questions can be used as an effective learning tool prior to a learning experience.

Students in high-performing and conceptually-oriented classrooms are expected to share ideas with others. Striving to explain their thinking helps students clarify their own ideas, even when their thinking is not totally clear, or their understanding is not well formulated. Students who must explain their thinking organize their thoughts differently, analyzing the strategies they employed by engaging in self-reflection and analysis.

Studies of questioning in typical mathematics classrooms confirm that most questions make minimal demands on student thinking. Low level questions include yes/no questions; guessing; simple recall of fact, formula, or procedure; leading or rhetorical questions; and those answered immediately by the teacher. Answers are often immediately judged right or wrong by the teacher, and discussion moves to the next question. Increasing the wait time between posing a question and expecting an answer increases the number of responses, student confidence, responses by less able students, and reflective responses.

Classroom Implications

Good questioning requires skill and planning. Strategies to improve questioning techniques include

- Plan questions while preparing lessons. Write out questions to launch a lesson, and compose clarifying questions to use during exploration.
- Choose different questions for varied purposes — clarifying questions, redirecting questions, summarizing questions, extension questions, and reflection questions.
- Tape lessons occasionally to monitor levels of questioning.
- Focus questions on searching for student understanding. Remove emphasis from right or wrong answers. Low-level questions do not give a good picture of a student's grasp of a concept.
- Listen carefully to student answers.
- Ask for a paraphrase of what has been said. This improves attentiveness and assesses comprehension.
- Assume that every answer given by a student is meaningful and "correct" to that student. The answers give insight into the student's mind by illuminating misconceptions and misunderstandings.
- Begin lessons with rich questions or problems to engage students and lead to new understanding of important content. Provide a variety of tools to assist mathematical exploration.
- Provide multiple opportunities for social interaction around mathematics ideas. People construct learning by questioning, discussion, and reflection.
- Allocate time carefully. Make notes from class to class on effective amounts of time for each explanation.
- Increase wait time. An observant teaching partner can assist.
- Model self-questioning by "acting out" your thinking when you approach a problem. "I wonder what I should do next? Maybe I should try ___."

