Batting 1,000: Questioning Techniques in Student-Centered Classrooms

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Questioning, like hitting a baseball, is both an art and a craft. Power hitters have innate talent, an art, that they practice continuously until it becomes their craft. Questioning used artfully can transform a classroom from a traditional lecture setting into a lively student-centered community. Questioning as a craft has techniques that all teachers can acquire to make a classroom vibrate with interactive learning.

The Art of Questioning: The Rules of the Game

To score in baseball, you first have to be able to hit the ball and place it where the defense is weakest. When art and craft fuse, and the wind is at your back, and the pitch is just right, you might hit a home run! So it is with the use of questioning in science classrooms. Questions can be used for checking for understanding, starting a discussion, inviting curiosity, beginning an inquiry, determining students' prior knowledge, and stimulating critical thinking. In the long run, questioning can be used to reduce student passivity and promote scientific literacy (Bonnstetter 1988). Questioning strategies used wisely can produce the kind of lifelong learner who can fulfill the responsibilities of a scientifically literate citizen. Every lifelong learner represents a home run for science education.

Just as there are different kinds of hits (e.g., singles, doubles, and triples), there are different kinds of questions in the student-centered classroom: those that (a) seek knowledge, (b) promote understanding, and (c) invite reflection. The first two kinds of questions can be categorized by the level of information students are asked to provide. Teachers can use Bloom's Taxonomy to develop questions that go beyond seeking knowledge. Teachers can also use scientific processes as instructional organizers when asking questions that promote understanding. (Such questions can be divergent or convergent, depending on the type of response desired: convergent questions direct the learner in possible pre-determined directions [e.g., an instructor leads an experiment in a certain direction]; divergent questions invite the learner to seek new knowledge, to go beyond what is stated.) The third kind of question, the question that invites reflection, leads us to new knowledge about ourselves and how we learn.

The Craft of Questioning: Batting Practice

As any professional knows, practice makes perfect. All beginning baseball players start out swinging and missing most of the balls pitched to them. Eventually they get mind, body, and timing synchronized and manage to hit a few pitches consistently. Likewise, the craft of questioning involves the synchronization of several elements:

Planning. The teacher decides on the type and levels of questions to use, depending on the lesson. The questions the teacher asks in a review session, for example, will be different from those he or she asks in a class devoted to the introduction to a new topic.

Classroom environment. The teacher should work to develop a classroom environment in which students actively listen, respond freely, and work with each other toward mutually designated goals.

Methods. Methods to be used during the presentation of a lesson may include wait time, listening, responding, and redirection of questions and responses. Wait time (Rowe 1986) is the time a teacher waits after asking a question before talking again. Research into this pause has found that the longer the pause (three to five seconds), the more thoughtful the response. Wait time

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is especially useful when asking higher-order questions. Preservice teachers who observed middle and high school science classrooms in western New York State reported that with little or no wait time, short answers were elicited (Freedman 2000). When wait time was increased, the quality of responses was greater. Listening and responding to students’ responses is a matter of focusing attention on students and not on coverage of material. Having developed that focus, the teacher can then redirect students’ responses down other avenues with new questions.

Reflection. Batters analyze their practices and listen to their coaches to improve their batting. So should teachers in regard to their questioning skills. To evaluate and guide improvement in the craft of questioning, teachers should record their instruction (via audio- or videotapes), use peer review or a personal survey to evaluate their performance, and invite peer critique. And, just as batters do with their coaches, so teachers should analyze instruction, applaud their own successes, identify areas of weakness, and set new goals. Synchronizing all the elements of the craft of questioning takes time, effort, reflection, and practice.

Teachers, reflecting on their questioning techniques in a study by Freedman (2000), reported that on a typical day they asked about twenty-four questions in a forty-minute class period. They asked twice as many convergent questions as divergent ones. They asked the same percentage of lower-order questions—knowledge and comprehension—as higher-order questions (application, analysis, synthesis, and evaluation). When asked what they could do to develop into better questioners, they replied, “More planning.”

When Art and Craft Converge: Stepping up to the Plate

Baseball players take chances every time they step up to the plate. A good hitter is someone who bats around .300—that is, he or she gets a hit three out of ten times at bat. Teachers should seek to bat at least .300 when it comes to quality questions. Imagine being a catalyst for learning, fielding questions, and directing learning. Imagine students who can solve problems, make informed decisions, and are stewards of the earth. These are goals set out for educators in the National Science Education Standards (NRC 1996).

When a batter steps up to the plate, many variables come into focus. That is also true when a teacher embraces a student-centered classroom. Figure 1 lists practices found in a student-centered classroom, contrasted to practices found in lecture-based classrooms. In a student-centered classroom, learning comes about as the result of a partnership between teacher and student. Many questions are asked, not all by the teacher, and students can practice their “batting” without risk.

Synergy in Questioning: Hitting the Home Run

What does a home run look like when there is synergy in questioning, when a teacher has fused all the elements of the craft of questioning into the art of producing a student-centered classroom? From a distance, the onlooker might say that chaos reigns in that classroom! The walls and ceilings teem with student work. Shelves overflow with diverse collections of well-used resources. Groups are engaged in various levels of investigation—strategizing, debating, and investigating. Students swarm around their projects, asking questions such as, “What do you think will happen next? Will it be different from the reaction we got yesterday?” Eventually the onlooker spots the teacher. She is seated at one table, her focus on a group of students wrestling with the results of their own investigation. She comments, “That’s quite an interesting graph. What is your data showing us?” There is a long pause. . . . Home run!

REFERENCES