Teachers want to teach as well as possible. However, they often do not know what changes will make a difference and rely upon their own experience, using trial and error, to make decisions about their teaching. Fortunately, we now have tools that show us how to teach effectively, and these tools are the result of educational research.

Effective teaching behaviors are those teacher behaviors that lead to improved student achievement. Most research studies pertaining to effective teaching tend to look at one aspect of teaching, but a common thread runs through many of the behaviors that these studies have identified as effective, and that thread is student involvement.

Student involvement indicates how actively students are participating in the lesson while it is taking place. Two important strategies, which are often overlooked, that a teacher can use to improve student involvement are: stating the lesson objective in the introduction to the lesson, and asking questions during the lesson.

**Objectives**

Participants will be able to discuss a lesson objective by explaining its parts.

Participants will be able to discuss effective questioning by explaining each strategy.

In preparing to improve teaching, we must consider what is involved in teaching effectively. First, teachers identify the subject matter that they want to present to their students, and, in deciding how to organize that information, they specify what to include, how to sequence it, and exactly what explanations to give to make it clear. Presenting the subject matter is only one of the things an effective teacher does. Actually, there are three tracks going on simultaneously. In addition to teaching the lesson, at the same time, the effective teacher is managing the classroom and guiding student achievement. Managing the classroom includes not only discipline, but all procedures that support the lesson, such as pacing the lesson and giving directions. Guiding student achievement allows the teacher to find out if the students are mastering the subject matter. Our objectives relate directly to guiding student achievement.

**Stating the Lesson Objective**

An effective lesson begins with the introduction, during which the teacher states the objective of the lesson. This describes what he or she is going to teach. Often when we do this, we simply say, for example, "The topic for today is slope." And when we make that statement, we really have not given the students any clue as to what they will need to know at the end of the lesson. We might simply be asking the students to memorize the definition of slope, but we might be asking the students to analyze which of various methods of computing slope is appropriate under certain conditions. The type of cognitive functioning that the
students will be doing for each of these tasks is dramatically different. By stating the objective clearly and specifically, we provide the way for students to get ready for the lesson and benefit from it.

Benjamin Bloom (1956) has designed a taxonomy of cognitive tasks that identifies and orders the levels of cognitive functioning. By using the taxonomy in writing the objective, the teacher specifies for students the cognitive level at which they will be functioning to achieve the lesson objective.

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**Taxonomy of Cognitive Levels**

(in order of increasing complexity)

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

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After selecting the cognitive level, the teacher can formulate the statement of the objective. The following template identifies the key parts:

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**Formulating an Objective**

TSWBAT --------------- by ---------------.

(taxonomy verb) (action verb)

TSWBAT  "The student will be able to"
This statement indicates that the students must be successful for the objective to be achieved.

taxonomy verb  examples: recall, explain, apply, compare, create, assess.
This verb identifies for the teacher and students the level of cognitive functioning required.

by

action verb  examples: stating, writing, calculating, performing, composing.
This verb identifies the observable behavior that the students will perform to ensure that they have achieved the objective.

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Improving upon our example, "The topic for today is slope," the following objectives would provide essential information for students:
Objectives for the Topic of Slope

KNOWLEDGE TSWBAT recall the definition of slope by stating it orally.

COMPREHENSION TSWBAT explain the definition of slope by stating it in his/her own words.

APPLICATION TSWBAT apply the formula for slope by calculating the slope of given lines, in writing.

ANALYSIS TSWBAT compare the slopes of several lines by stating their similarities and differences, in writing.

SYNTHESIS TSWBAT create a new use for slope in mathematics by demonstrating it.

EVALUATION TSWBAT assess the value of the concept of slope in calculus by defending a position in an essay.

Note that a verb such as "understand" is not suitable. It could not be a taxonomy verb, because it is too vague, and it could not be an action verb, since it is not an observable behavior.

The well-stated objective has additional value in relation to how we learn. Students must be able to function at the lower cognitive levels before they can function at higher levels. Learning on any topic proceeds through the taxonomy levels. Students must have information at the knowledge level - facts - before they can perform at any of the higher levels. For example, they could not participate in a discussion on a given topic if they did not first comprehend the facts that bear on the analysis of that topic. Bloom states that as students perform better at the lower levels, their success at the higher levels is more likely. He calls this automaticity, "the hands and feet of genius" (1986, p. 70).

Having stated the objective, the teacher is more likely to teach to that objective and then evaluate for that objective. Students are most successful when their teacher uses this consistent sequence, known as curriculum alignment. Therefore, the well-stated objective may save a teacher from receiving the kind of comments recently listed in MIT's Course Evaluation Guide:

Course Evaluations

"Problem sets are a decoy to lure you away from potential exam material."

"The course was very thorough. What wasn't covered in class was covered on the final exam."
Asking Questions

After the introduction, the students are cognizant of the objective and ready to attend to the teacher’s presentation of the lesson. It is well known that lecturing to a class is not a very effective way to deliver instruction because it does not actively involve students in the lesson. Guiding student achievement during the lesson is essential for ascertaining if the students are mastering the subject matter.

Now the teacher may think, “I know that my lesson is excellent. I have given this lesson several times for several years, I have modified it and refined it, and I know that I am explaining it as well as it can be explained.” Until the teacher asks the students questions, the teacher does not know if the lesson is effective, and often, that does not happen until an exam, when it is too late. In a well-designed lesson, the teacher asks questions during the lesson.

Asking questions enables the students to stay involved, since their comprehension is verified throughout the lesson. Asking questions enables students to achieve more, because it models for them how to question themselves when they are trying to solve a problem, and it helps them identify the thinking processes that they need to use.

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Outcomes of Asking Questions

- Assess if the students are mastering the objectives.
- Keep the students actively involved.
- Identify student’s thinking processes, for the teacher and for the student.
- Model how to question one’s self to solve problems.
- Assess readiness for raising the cognitive level.

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Although asking questions is valuable, we often do not do so. One reason may be that whenever we ask a question, we put control into the hands of the student, and we do not know what the student is going to say. The student may get the answer right, may get the answer wrong, or may say nothing at all, and we have to do one of the most difficult tasks in teaching, which is to make a decision right then, on our feet, about what to do next. Keeping this in mind, we will look at how to ask a question effectively and how to reply to the student’s response.

The teacher should ask the question and then call on the student. This sequence is important, because when the teacher asks the question first, all students prepare an answer. Calling on all students, not only volunteers, encourages students to stay involved. After calling on a student, the teacher allows the student time to think, and this is called wait time.

Effective teachers wait three seconds before saying something to the student. That seems like a trivial amount of time, but most teachers on average wait one to one-and-a-half seconds. Three seconds of silence in the classroom feels like an enormous amount of time to be waiting, and the teacher must wait the three seconds patiently, in a relaxed way, until the student says something. These periods of silence are so
disturbing to us that in order to train teachers to wait, a traffic-light type device was needed to demonstrate to the teacher when three seconds had passed (Gooding, Swift, & Swift, 1983a).

| Sequence of Teacher’s Questioning Behaviors |
|-------------------------------|---------------------------------------------|
| Ask a question | Call on the student | Allow the student time to think | Listen to the student’s response | Provide feedback |

Sometimes, when the teacher asks a question, especially if it is a hard question, the teacher looks around the room and thinks, "Who knows how to answer this question best? I do!" The teacher answers the question, and the students are not involved. Although the teacher probably can answer the question best, doing so misses the whole point of questioning, since the objective of asking questions is not merely to convey information.

Let us first suppose that the teacher asks a question and the student responds with a correct answer. The teacher provides feedback, which is positive and specific. The teacher may follow up with another question, or elaborate on the student's answer as the lesson continues.

Consider an example of what often occurs when the answer is wrong.

Teacher: What is the definition of slope?
Student: That's one of the axes, right?
Teacher: That's wrong. Does anyone else have an answer? Can someone help her out?

When the teacher asked the question and the student answered incorrectly, note the teacher's behavior. The teacher turned away from the student and called on someone else. The spotlight is off the student, and he is not the subject of everyone looking at him and focusing on the fact that he answered incorrectly. However, consider what this has done. The student is relieved, but the student is also feeling dejected and stupid. This is a critical point. When the teacher turns away from the student, the teacher is clearly saying to him, "I have asked you a question, and you got it wrong, and I am turning away from you - physically and mentally - and I am tending to someone else. The only important thing in this classroom is to get the correct answer. You and your lack of understanding will not alter the flow of the lesson."

A more effective technique requires that once the teacher calls on a student, the teacher stays with that student until he or she gets something right that the teacher can praise. Let us go back again and re-play the wrong answer:

Teacher: What's the definition of slope?
Student: It's one of the axes, right?
Teacher: That's not the right answer, but looking at the axes is part of thinking about slope. What we're asking when we calculate slope is how steep is the line, so we will look at one of the axes - you're right - we will look at the y-axis to see how rapidly the line rises, and we will look at the x-axis and ask, compared to the rise, how rapidly does the line move in the x direction. We are going to ask, what is the change in y compared to the change in x. You are correct in saying that the definition of slope includes the axes, but we need to incorporate their role into the complete definition.
It is critical that the teacher states that the answer is not correct and does not let the class think that this answer might be right. Feedback to one is feedback to all. If the teacher does not make it clear that the answer is not correct, other students might think, "Oooh, I thought that answer was wrong, but maybe it's right."

In this case, where we are dealing with a definition, there is not a lot of latitude. But the teacher has to find something to identify and praise. It may be that part of what the student said is right, and that part can be affirmed. If not, the teacher can re-state the question and, in doing so, ask the question with a clue in it. Other alternatives include asking a question at a lower cognitive level or asking a question that is a part of the original question. But the teacher stays with the student until the student has said something that can be praised.

During the time that the teacher goes through this procedure, the spotlight is on the student and he may be feeling some discomfort, but he ends up feeling, "This is okay. I know what's going on." This critical technique may seem hard to do, but it is an essential strategy of the effective teacher. When a student does not know an answer, we stop, diagnose the problem, and correct the problem so that when we go on with the lesson, the student can continue to be involved.

Some of the questions asked can be process questions, such as: "How did you arrive at your answer?", or "Tell me what you are thinking when you say this." These questions help the student to get in touch with his or her thought processes and see exactly what is occurring in solving the question.

Sometimes, after the student has given an answer, if we wait a little more, he or she will add to the answer. Once the student has stated a first response, other information may come to mind, and the student will speak again. To encourage students to think more deeply, the teacher may want to observe a second wait time after the initial response. If the question simply requires factual information, this will usually not be needed, but when higher order questions have been posed, the second wait time is valuable.

Some teachers think that asking questions in the midst of the lesson is going to take more time. Actually, questions used throughout the lesson do not use significantly more time because they accomplish tasks in a different way. For example, the teacher may use questions to emphasize an important point. Rather than repeat the concept, the teacher asks a question that elicits the important point from a student. In addition to the class benefiting from hearing the concept re-stated, the student who answered profits from recalling and expressing the information. Similar benefits result for all students when the teacher uses questions to guide a student to explain thinking processes.

Once students have successfully answered our questions, we can then decide if they are ready for cognitively more difficult material. It is always a goal, though a difficult one, to move students to higher order thinking skills. Students will be more inclined to move into higher cognitive levels if they know that when they give an answer that is not correct, they will receive the guidance that they need to understand their thought processes and to reach an accurate response. At this level, the questions may have divergent answers or may have several answers.

In closing, we have examined how teaching can be improved through two strategies that enhance active student involvement in the lesson. When the teacher states the objective precisely, both the teacher and students know what is expected cognitively. And when the teacher asks questions during the lesson, both the teacher and the students have immediate feedback on the success of the lesson.
References


