

Integrating Exit Questions into Instruction

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Assessment should be more than a summative quiz or test to measure students learning. Rather, assessment should be integrated into instruction to provide regular feedback that can be used to guide further instruction as well as enhance student understanding. It should be used in multiple formats to measure not only procedural but deeper conceptual understanding. One assessment strategy that we have successfully used in professional development courses and initiatives for in-service mathematics teachers in Vermont* is to present periodic exit questions. Such questions have helped us measure participants' understanding of the mathematical concepts that we have covered during our sessions. These formative questions are presented and answered in a short period of time at a natural breaking point in instruction, and provide immediate feedback about participant understanding of the "big picture." They also provide an opportunity to modify instruction and address any widespread confusion or difficulty. We have also used a variation of the exit question strategy in the form of entrance questions which enabled us to gauge participants' prior understanding of course content.

This summer we offered weeklong courses on algebra and functions to elementary school teachers as well as courses on statistics and "making informed decisions" to middle school teachers. During all courses, we presented exit questions at the end of the morning and afternoon activities. The instructors considered participants' responses over lunch and after the daily sessions were completed.

Many of the questions were open-ended to emphasize the importance of thoroughly understanding concepts and carefully communicating mathematics, rather than short-answer questions that asked participants to simply practice rote memorization of mathematical facts. These formative questions allowed participants to measure their own understanding of the topics and course focal points. They also allowed instructors to assess the level of understanding of each lesson and to determine whether more time was needed to discuss a particular concept.

During the session for elementary school teachers, we emphasized the properties of and distinctions between linear functions and certain types of nonlinear functions. Thus, one of our exit questions asked participants to consider a tabular functional representation and to reason whether the example was linear or nonlinear.

For the middle school teachers, we underscored the importance of using data to make informed decisions. Some of our exit questions asked participants to compare the level of risk in common scenarios, and other questions asked them to create graphical displays in various contexts. Two examples follow:

- In the United States, if about 40,000 die each year in motor vehicle accidents and less than 1,000 die in airplane crashes, what would you report about the risk in each mode of transportation? Why?
- Suppose a teacher gave a test that was too hard, in the sense that students had not developed the kind of understanding necessary for performing well on the test. Provide a graphical display that would represent student scores on the test. Explain why your graph indicates that the test was too hard.

In the responses to the first exit question, we encountered misconceptions about the nature of the underlying reference group, and addressed those confusions in small group discussions. We also had the middle school teachers address exit question feedback through homework discussion groups—small randomly selected groups that were overseen by an instructor and discussed the homework problems, readings, and exit questions from the previous day. Creating smaller groups enabled participants to get to know one another in a nonthreatening setting and gave them an excellent opportunity to review concepts and talk about common misconceptions. In their responses to the second example, students exhibited a strong understanding of the concepts, as demonstrated by their ability to both display and interpret a graph representing data that met the criteria.

Exit questions such as these are a useful tool that can be used in a variety of educational situations and can offer valuable information and perspectives to those involved in mathematics education in various contexts and at various grade levels.

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Assessment Issues

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Assessment should be more than a summative quiz or test to measure students learning. Teacher educators in Vermont share an effective way to use exit questions to aid teaching and learning.

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