Construct Validity: Wording the Questions

This aspect of content validity is closely tied with an ongoing debate about the relative merits of qualitative and quantitative data (Libarkin & Kurdziel, 2002ab).

Qualitative: If you interview a student, or put an open-ended essay type question on a survey or quiz, you can get a reasonably clear picture of what the student is actually thinking. Scoring open ended questions is very time consuming, and requires consistent scoring rubrics, which in turn depend on clearly defined objectives. Once the essays are scored, you have a quantitative measure of student understanding, but many people prefer the approach below.

Quantitative: If you put a multiple-choice question on a survey, you can easily count the number of students who get the right answer, so this sort of question is considered more quantitative. However, any time you ask a multiple-choice question or a simple yes/no, you are using some model of the students' thought process. You are assuming that you understand the reasons for the choices students make. The danger of this sort of assumption is illustrated below. For a simple question about paleontology, a list of possible responses is given.

Question: Did dinosaurs ever coexist with humans? (Y/N)

Examples of Possible Answers

Y/N	***Thought Process***	***Comments***
N	Dinosaurs went extinct 65 million years ago, during a mass extinction caused by an asteroid impact. Humans have only been around ~5 million years.	This is what we might assume a student thinks.
N	Dinosaurs are extinct	So are passenger pigeons. Reasoning slightly flawed
N	"Old" appearing dinosaur bones were buried by God, about 4000 years ago, to test our faith in His revealed world. Dinosaurs never existed.	Right answer, specious reasoning.
Y	"Jurassic Park" was a documentary, right?	
Y	Current paleontological research classifies birds as living, feathered, dinosaurs.	That's right! (thanks to J. Libarkin for example)
N	Any time humans and dinosaurs encounter each other, one of them ends up dead. So they can't coexisit.	

Clearly, counting the "no" answers to this question would not give a *valid* picture of student understanding. This question needs to be validated using qualitative data. "Think alouds", in which a student describes his or her thoughts while filling out a survey, can be video-taped for analysis. The simple yes/no question can be accompanied by a request for written clarification or explanation.

Using Qualitative Data to Develop a Quantitative Survey Instrument

Another use of qualitative data is to learn what misconceptions students hold commonly. These misconceptions must be included as "distractors", or possible incorrect answers, in any multiple choice survey. For example, the preliminary survey asked "how deep is the ocean, on average?" Student responses varied widely, but some of the more common responses are now used as distractors in a multiple choice question (below).

Q: How deep is the ocean, on average?

a) 100 yards
b) 1 mile
c) 500 meters
d) 4000 meters
e) 20,000 leagues
f) 6000 kilometers

This question is certainly easier to score than the preliminary open-ended question, and provides quantitative data directly. When I showed a copy of my survey to a colleague with experience in educational research, she glanced at the open-ended questions, including the ones with clear right and wrong answers, but focused immediately on the question above as being the most quantitative.

One Downside to Using Qualitative Data

I wrote an open-ended question for use in my own class and for high-school participants in the National Ocean Sciences Bowl. "What was the most interesting thing you learned this semester?" The undergrads gave thoughtful, articulate answers. One high school student wrote "male sharks rape female sharks. I am a changed man." This answer reveals something about maturity, not about ocean literacy. In general the NOSB respondents didn't take the survey seriously; my surveys may work best in the context of formal education.