Week 12: The test construction process

Session 1: Begin with a blueprint (Table of Specifications) for the test

In class today (5 minutes)

Tell the Student Teachers that this week they will learn how to create an achievement test. To begin, three terms need to be clarified: *objective*; *topic*, and *category*. When Benjamin Bloom created his taxonomy, he referred to the cognitive processes he thought teachers should help students develop as learning *objectives*. That terminology is a variation on the way the term *learning objective* is used in this course.

In the course, *learning objective* refers to a knowledge and/or skill that a student should acquire from a specific lesson and is tied to a particular subject matter topic. In each case (Bloom's use of the term *objective* and the use of the term *objective* in the lesson plan template taught in this course), the focus is learning. Bloom was thinking about learning and mental processes. The lesson plans in the course are focused on learning and subject matter topics. The two perspectives are not identical, but they are complementary. The terms *category* and *topic* are used in reference to subject matter. *Category* refers to clusters of related subject matter topics (for example, celestial motion). *Topic* refers to more specific subject matter knowledge or skill (for example, the Earth's axis and related motion).

Introduce a template for a Table of Specifications (5 minutes)

Distribute the handout 'Template for Table of Specifications for Sun, Earth, and Moon Unit Test'. Tell Student Teachers that a fair test assesses all the topics taught during an instructional unit (that the test is assessing) and stays away from topics not covered by the teacher. How do teachers make sure that they fairly cover the content taught during an instructional unit?

One of the tools used by teachers is a blueprint for the test called a Table of Specifications. In other words, the Table of Specifications is a technical name for the blueprint of a test. Constructing a blueprint for a test assures that the teacher has adequately covered the subject matter for the test and matched the test items with the appropriate learning objectives.

Direct Student Teachers' attention to the template. A Table of Specifications is a two-way grid on which the teacher lists the subject matter topics (typically called *content*) to be included in the test. (The subject matter topics [content] are listed in the far left column of the grid.) The learning objectives to be included in the test are typically drawn from Bloom's Taxonomy of educational objectives and written into the lessons to be covered in the test. The learning objectives are written across the top row of the grid.

Bloom's original taxonomy includes six cognitive processes arranged in a sequence of increasing complexity (knowledge, comprehension, application, analysis, synthesis, and evaluation). Assessment specialists suggest that teachers creating a Table of Specifications for the first time start with a simple cognitive framework that includes the first three cognitive processes (knowledge, comprehension, and application).

Introduce the process of constructing a Table of Specifications (15 minutes)

In this activity Student Teachers will study the template for a Table of Specifications for the 'Sun, Earth, and the Moon' unit test to learn about different features of a Table of Specifications. Keep Student Teachers' attention focused on the template and discuss the process for constructing a Table of Specifications with them.

When constructing a Table of Specifications for a test, teachers:

- identify the learning objectives in the lessons on which the test is based and place them in the top row of the table.
- group the subject matter topics in the lessons to be covered by the test under the appropriate learning objective. (This has been done for the Student Teachers. See 'Learning objectives from lessons in the Sun, Earth, and the Moon unit grouped by subject matter topics '.)
- group the subject matter topics into four or five content categories and label each category (for example, 'objects in the solar system').
- decide on the total number of questions on the test based on the number and complexity of the subject matter topics to be covered by the test and the time that can be allocated for taking the test.
- record this total number of test questions in the appropriate place on the table.
- decide on the number of test questions to be assigned to each subject matter topic and learning objective based on professional judgement about the importance of the subject matter topic and the learning objective to the goal of the unit and the amount of instructional time devoted to the subject matter topic and the learning objective in the unit's lessons.
- record the number of proposed questions in each of the boxes in the table.
- total the number of test questions proposed for each subject matter topic (rows).
- record numbers in the appropriate boxes on the table.
- total the number of questions proposed for each learning objective (columns).
- record numbers in the appropriate boxes on the table.
- determine the percentage of questions assigned to each subject matter topic and each learning objective and record in the appropriate boxes on the table.
- study the distribution of questions by subject matter and learning objective and determine if the distribution reflects adequate coverage of the content and learning objectives in the lessons on which the test will be based. If not, they revise the distribution of questions.
- write test questions for the test using the distribution by topics and objectives in the table.

NOTE: In the template for the table distributed to Student Teachers, Bloom's knowledge category is subdivided into definition and recognition and identification.

Small group activity: Creating subject matter (content) categories (10 minutes)

After discussing the process of creating a Table of Specifications, divide Student Teachers into groups of three. Ask each group to choose a reporter. Make sure they have two handouts (the template and the subject matter topics for the Sun, Earth, and Moon unit grouped by learning objective). Tell the Student Teachers to group the subject matter topics into four or five content categories (for example, relationships between the Sun, Earth, and Moon). Tell them to enter their content categories on the Table of Specifications template in the column labelled 'content'.

Small group activity: Creating a Table of Specifications (25 minutes)

Ask Student Teachers to remain in their groups but direct their attention to the front of the classroom. Choose four groups to send their reporters (one at a time) to the front of the room to report on their content categories. The purpose of this exercise, hopefully, is to show that, though they are working with the same list of subject matter topics, groups will not necessarily create the same content categories. Then tell them to return to work with their groups and turn the template into a completed Table of Specifications. Because they are familiar with the lessons in the solar system unit, they can use that knowledge to decide how many questions to include in the test and how to distribute those questions across the subject matter categories and learning objectives. After deciding on the total number of questions for the test and assigning numbers of questions to each subject matter category and learning objective, it is easy to calculate totals and figure percentages. Then each group must decide if their Table of Specifications gives adequate coverage to the solar system content and the learning objectives in the unit (knowledge, comprehension, and application). If not, they have to revise the numbers in the table.

The goal for this activity is to finish it in the time allotted so each group's table can be given to you, the Instructor, when the class ends. You can then provide written feedback and return the tables at the beginning of the next class.

Homework (10 minutes)

If most groups are not finished completing the Table of Specifications and you choose to give them additional time as homework, assign a one-page paper in which Student Teachers:

- explain the purpose of a Table of Specifications for a test
- describe any challenges they foresee in constructing blueprints for tests when they have their own classrooms
- give an opinion as to whether the value of a blueprint makes facing the challenges worthwhile.

If Student Teachers have given you their test blueprints, distribute the completed 'Table of Specifications for the Sun, Earth, and the Moon Unit Test'. Tell Student

Teachers to study it in preparation for comparing it with the Table of Specifications they created for the same science content and learning objectives. It is important for them to think for themselves in this exercise rather than be influenced by the blueprint on which the unit test was based. Ask them to think about the claim assessment specialists make when they write 'professional judgement is the essence of classroom assessment'. Ask the Student Teachers to consider if creating a Table of Specifications for a test is a good example of that claim. If so, why? Tell Student Teachers that the role of professional judgement in creating a Table of Specifications will be a discussion topic for the next class.

Session 2: From learning to create a Table of Specifications to learning to write test questions

If Student Teachers have not been given the 'Table of Specification for the Sun, Earth, and the Moon Unit Test' handout and 'Learning Objectives from Lessons in the Sun, Earth, and the Moon Unit Grouped by Subject Matter Topics', do so now.

In class today (5 minutes)

Announce the plan for today's class:

- Study the subject matter categories in Student Teachers' tables in comparison with the table created for the solar system unit test.
- Study the distribution of test questions across learning objectives in Student Teachers' tables in comparison with the distribution in the table created for the solar system unit test.
- Consider the role of professional judgement in creating a Table of Specifications for a test: what do educators mean when they use the term 'professional judgement'?
- Discussion of the role of professional judgement in creating a Table of Specifications for a test.

Class activity: Comparisons between Student Teachers' tables and the table created for the solar system unit test (20 minutes)

Write the subject matter categories from the table on the board or chart paper. (These were the subject matter categories used to create the test for the unit on the solar system.)

Ask the reporter for each group to report on the group's subject matter categories.

For each category that is the same as a category in the example, put a check beside it in the list of categories in the example.

For categories that are not in the example, write each category name on the board or chart paper.

Follow the same procedure with the distribution of questions across learning objectives.

For each total distribution that is the same (knowledge 16 [combine the two knowledge objectives], comprehension 10, and application 9), put a check in the box with the total number of application questions.

Write each different distribution on the board or chart paper.

Discuss each subject matter category that is different from the example.

Decide if the category is really not in the example or if it is actually similar in content to a category in the example. If the majority of Student Teachers in the class believe that it is similar, erase or mark through that category. If there are categories that remain, ask the members of the group that included that subject matter category to explain the reason. Tell Student Teachers to use their memory of the lessons in the solar system unit and the list of subject matter topics in the handout that groups subject matter topics by learning objectives to help with this task.

Follow the same procedure with the distribution of questions across learning objectives. If the numbers really aren't very different, erase or mark them out. If distributions are different (for example, 9 knowledge questions and 17 comprehension questions), ask for an explanation. Ask Student Teachers if, based on this comparison between the table for the solar system unit test and the Student Teachers' tables, they have recommendations for changing the Table of Specifications for the unit test. (In actual practice, this would also mean changing the test.)

A definition of professional judgement (10 minutes)

Explain that *judgement* refers both to an outcome (a decision, an opinion, or a conclusion) and to the mental process of reaching that outcome (for example, Ms Khan uses good judgement when she makes decisions about thought-provoking questions for a classroom discussion). Professional judgement is judgement used in the context of work. Professional judgement is formed, in part, by knowledge and skill and also by experience and personal values. Professional judgement is necessary when a teacher has to make decisions for which there are no rules and when he or she does not have a prescription or script to follow while teaching.

Ask Student Teachers if and when a teacher uses professional judgement in the creation of a Table of Specifications.