How Do You Know If They're Getting It?

Writing Assessment Items That Reveal Student Understanding

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Goals

1. Discuss principles and <u>a</u> process for writing <u>multiple choice</u> assessment items <u>that reveal student thinking</u>.

2. Use the principles and process to write and revise items.

Overview of Session

- Overview of item development process
- Item writing guidelines
- Collaborative item writing
- Cognitive interviewing
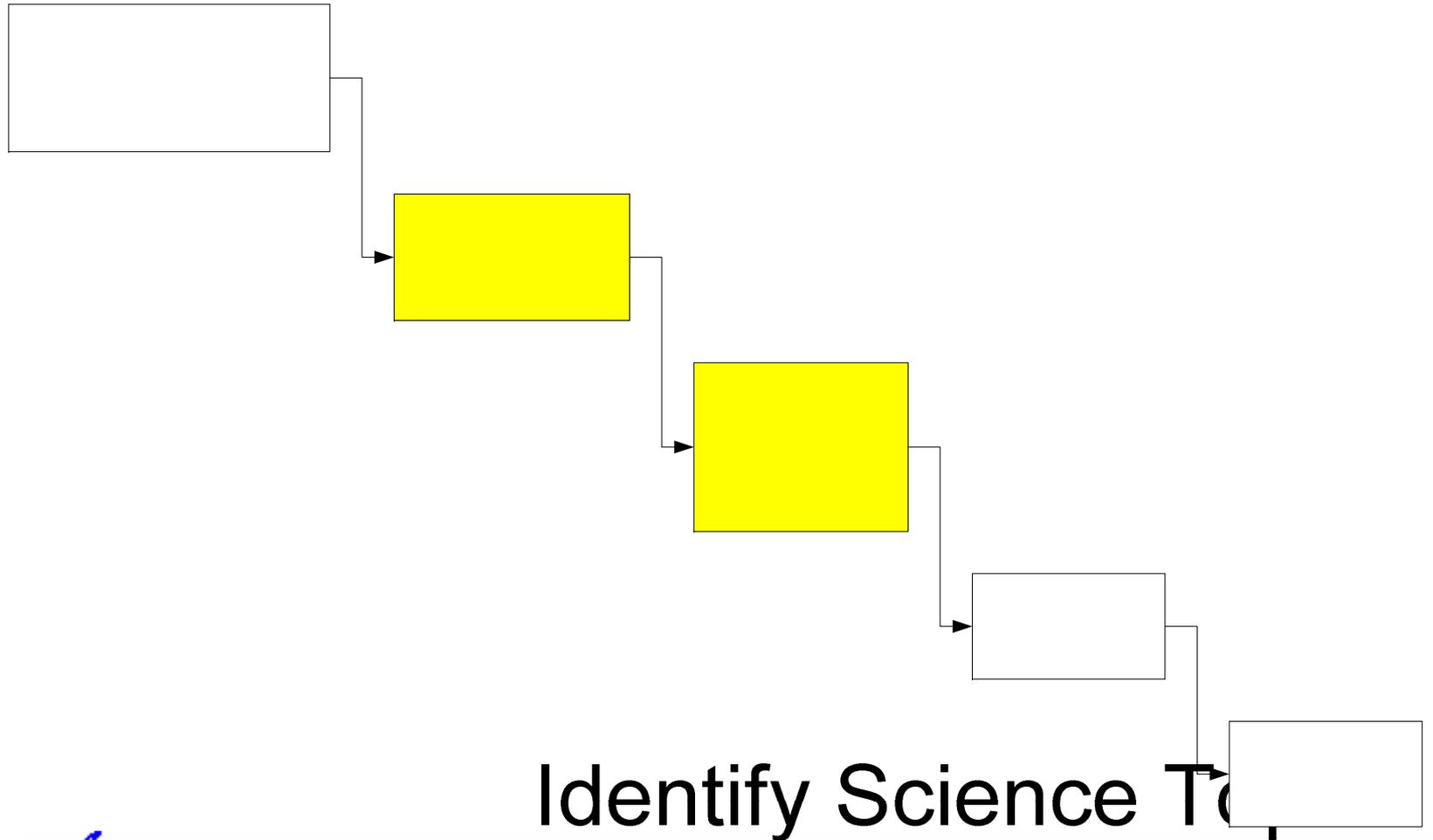- Revising items based on interview feedback
- Wrap up

Assessment Development Process

Assessment Development
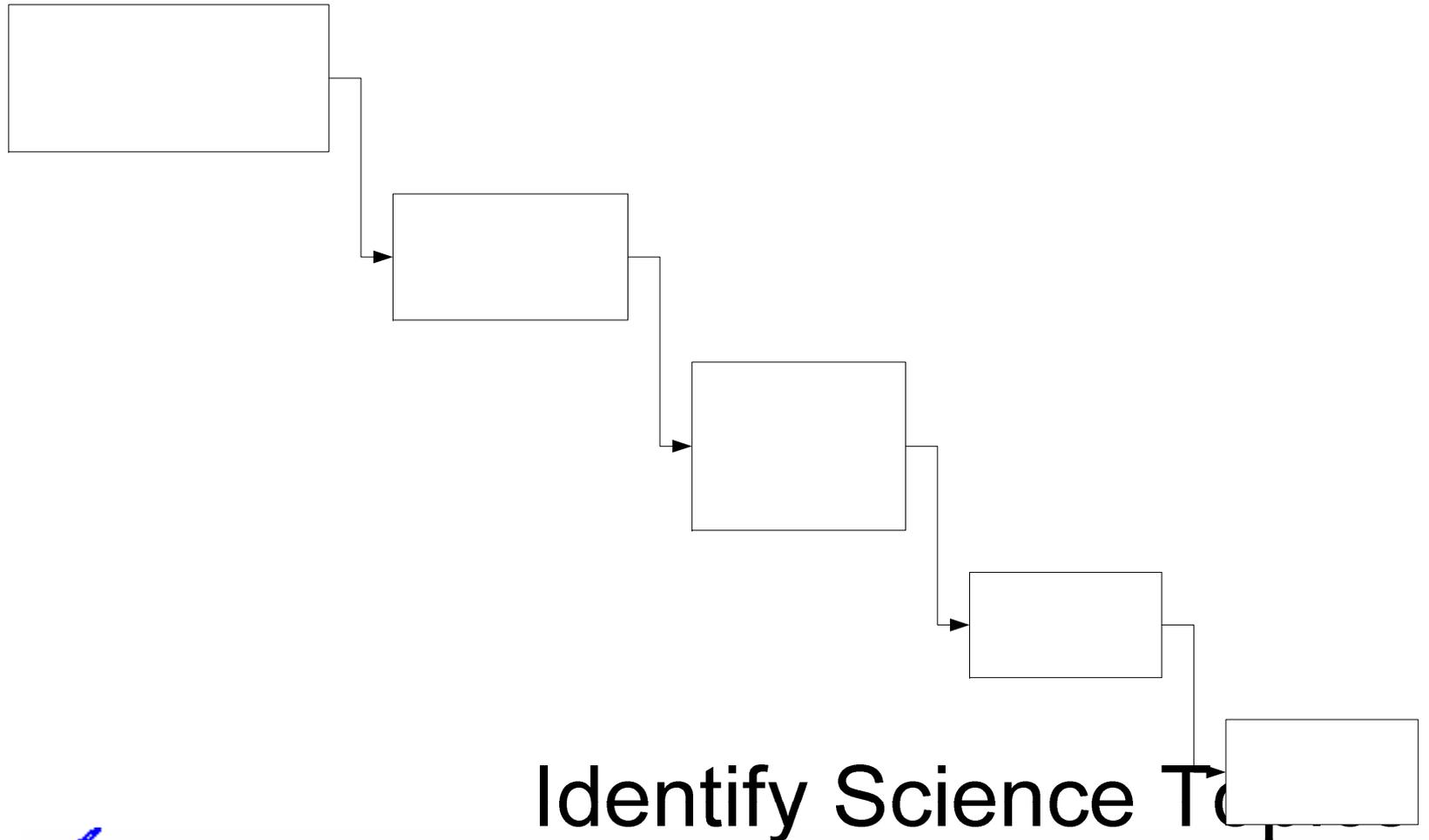
Identify Science Topics
and Student Thinking
About These Topics

Assessment Development

Identify Science To[pics]
and Student Thinking
About These Topics

Step 1: Identifying Science Topics

Overview of Content

- See content clarifications on table (yellow)

- Development of clarifications

- Sub-ideas are the smallest assessable piece of information

Item Writing Guidelines

(blue paper)

Categories of Guidelines

- Content
- Facilitating comprehension of the item
- Structure
- Format

Content

Content

1. One sub-idea per item if possible.

Why?

- Precision
- Good coverage of all sub-ideas
- Cognitive load gets higher as more sub-ideas are being assessed within one item

Content

2. The right answer should be about the sub-idea; it's best to have distractors be within the same sub-idea, but they may be about other sub-ideas as long as they're within the benchmark.

The Necessity Principle

The knowledge in the sub-idea is needed to answer the item.

OR

The item cannot be answered correctly without knowing the sub-idea.

The Sufficiency Principle

The knowledge in the benchmark is ALL a student needs to know to answer the item correctly.

OR

Answering the item correctly requires NO knowledge outside the benchmark.

Force and Motion Benchmark

An unbalanced force acting on an object changes its speed or direction of motion of both.

Example:

Which of the following is a force that opposes motion?

A. Acceleration
B. Inertia
C. Momentum
D. Friction

Content

3. Items should not teach content.

Example:

A girl gets on her skateboard and pushes off with her foot. As she moves across the gym floor, she moves slower and slower and eventually comes to a stop. Why does she come to a stop?

A. Because the force due to her foot runs out.
B. Because the force in the skateboard runs out.
C. Because the force of friction is acting on the skateboard.
D. Because the force due to gravity is greater than the force due to friction.

Correction

A girl gets on her skateboard and pushes off with her foot. As she moves across the gym floor, she moves slower and slower and eventually comes to a stop. Why does she come to a stop?

A. Because the force due to her foot runs out.
B. Because the force in the skateboard runs out.
C. Because the force of friction is acting on the skateboard.
D. **Because there are no forces acting on the skateboard.**

Content

4. Answer choices should reflect the question being asked.

Example:

A sailboat is traveling in the ocean, as shown in the diagram. The wind exerts a force that pushes the boat forward (toward the right side of the page), and the water exerts a weaker force to the left.

How do these forces **interact**?

A. The forces combine to create a total forward force that is smaller than the force due to the wind.
B. The forces combine to make a total forward force that is larger than the force due to the wind.
C. The forces cancel each other out.
D. **The force to the left doesn't matter because the force to the right is stronger.**

Facilitating Comprehension

Facilitating Comprehension

5. Keep sentences brief and straightforward, with a simple phrase structure and no additional clauses.

Facilitating Comprehension

6. Use present tense and active voice only.

Example:

A shopping cart is pushed so that it moves faster and faster. What is true about the situation?

Correction:

A man is pushing a shopping cart. The cart is moving faster and faster. What must be true about the situation?

Facilitating Comprehension

11. Visuals should facilitate the understanding of what is being asked; don't include a visual just to include a visual.

- No extraneous information
- Should complement the presented scenario
- Labels should mirror wording in the item

Most Important Rules

1. One sub-idea per item if possible.
2. The right answer should be about the sub-idea; it's best to have distractors be within the same sub-idea, but they may be about other sub-ideas as long as they're within the benchmark.
   - ❖ Necessity—item can't be answered without the knowledge in the benchmark.
   - ❖ Sufficiency—item doesn't require any knowledge outside the benchmark.
3. Item should not teach.

Questions?

Using the Item Database

(white paper)

Writing Items in Pairs

Helpful Hints

- Use the "related prior student conceptions" as a source of distractors.
- Interview your own item:
  - Does the item address a specific sub-idea?
  - Are the distractors within the benchmark? (Students should be able to choose the right answer and rule out the wrong answers using the ideas within the benchmark.) (necessity and sufficiency)
  - Does the item avoid teaching other sub-ideas within the benchmark?
  - Do the answer choices answer the question being asked?

Write Items

Please put your table tent down
when you've written one item.

Cognitive Interviews

Purposes

Cognitive interviews help with:

1. Validity;

2. Clarity;

3. Plausibility; and

4. Improvements.

Purposes

1. Validity

- Is the student getting the item correct/incorrect for the appropriate reason (i.e., understanding/not understanding the knowledge being measured rather than the wording being tricky or because of test wise-ness)?

- Does the student use the knowledge you are trying to measure to answer the item?

- Does the student think the item is asking what you intended it to ask?

Purposes

2. Clarity

   - To make sure the item is clear and the wording and/or graphics are not confusing

3. Plausibility

   - To determine if the scenario is realistic

4. Improvements

   - To elicit suggestions for alternative distractors (e.g., one that may be more realistic or better aligned with a common misconception)

Interview Protocol

(purple paper)

Procedure

- Ask student to read and think aloud as they read the item and consider the answer choices.

  - Gives you a sense if wording is tricky (e.g., s/he re-reads the item several times); and

  - Helps you determine why student is answering the way s/he is (e.g., real understanding, guessing, test wise-ness).

Item-Specific Questions

1. Why did you choose that answer? **[Validity]**
2. What did you think of each of the other answer choices? **[Validity]**
3. Was there an answer choice you were expecting to see, but did not? What was it? **[Improvements]**
4. Were there any words or diagrams you did not really understand? **[Clarity and Plausibility]**
5. Is there anything about the question that did not confuse you, but that you think might confuse other students? **[Clarity and Plausibility]**

Interview Tips

- Remember: Main goal of interview is to check validity of item; to do so requires understanding why interviewee is responding the way s/he is, but does not require understanding all of his/her ideas about the content.

Logistics

- Pair up with another pair.

- Designate one pair as "student."

- Select one of the interviewer's items from the item list.

- Interview student about 1 item.

- Pairs switch roles.

- Keep notes about any changes suggested by the interview.

- Make a new version of the item, if necessary.

Debrief the Interviews

Wrap Up

Take Away's

- To reveal student thinking, items need to meet the necessity and sufficiency criteria.

- Misconceptions-based distractor's reveal more than just whether the student got the item right or wrong.

- Students are a valuable source of information about item validity.

- Collaborative item writing has many benefits.