APPENDIX 2:   EXAMPLES OF POSIT ITEMS

Prelude to examples

Note that a full POSIT test will contain general information and directions for test takers about answering the items. This will include a prominent paragraph noting that national standards for science education recommend inquiry approaches to science teaching, as well as the promotion of higher order reasoning skills in learners. POSIT test takers will be expected to keep this in mind when answering individual items.

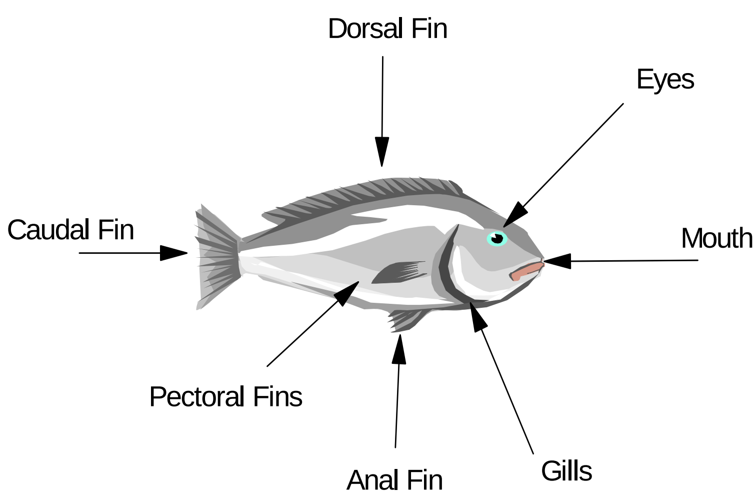
Vignettes, questions and choices

Each item begins with a classroom teaching vignette. The vignette is turned into a problem by asking a question about the pedagogy that i. requires higher-order thinking skills (as defined by Bloom’s taxonomy); and ii. addresses the Inquiry-Item-Criteria. Several types of question could meet these criteria. For example, a question might be for an evaluation of the lesson thus far.

The item then offers a set of alternative choices regarding pedagogy, to choose from.

EXAMPLE ITEM 1. This example is about a 3rd grade classroom lesson on fish

Mr. Lowe is a 3rd grade teacher. Two of his eventual objectives are for students to (1) learn at a simple level about the relationship between form and function, and (2) be able to predict how function may change with a change in form. He begins a specific lesson on fish by showing an overhead transparency of a fish, and then labeling several parts of the fish as shown below.



Which of the following statements is the best evaluation of the lesson so far?

A. This is a good lesson so far, because the teacher is clearly and systematically introducing the vocabulary that the children will need for further studies of fish.

B. This is a good lesson so far, because by learning the names of the fish parts, the students are more engaged and will ask appropriate questions about their function.

C. This lesson is not off to a good start, because it begins with the teacher giving the children information about fish, before any attempt to develop a sense of questioning or investigation on the part of the students.

D. The lesson is not off to a good start, simply because it begins with the teacher doing the talking, which is never a good idea.

E. This lesson is not off to a good start, because the students are not doing anything "hands-on." There should always be real fish for students to observe, so they would then connect the lesson to the real world.

COMMENTS

The portion of the lesson in the vignette meets none of the five Inquiry-Item-Criteria (IIC) labeled a – c in the project description. It is also far right on Table I of inquiry features and variations.

Of the four responses, “C” is the desired response according to the Inquiry-Item-Criteria. “C” suggests the teacher should engage students through questioning about what they notice and what they know about fish. The teacher should guide students to describe the various fish parts and ask students to pose questions about what the parts do for the fish. As it is described, the lesson does not necessarily engage the students’ thinking.

Response “A” and “B” align only with knowledge-level objectives, whereby the intent is for students to know the vocabulary. Knowing formal names of body parts is not a necessary criterion for associating form and function and the approach is not inquiry.

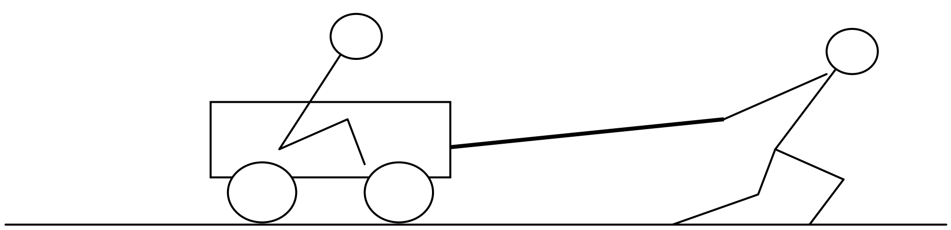
Response “D” suggests that a good inquiry lesson is *never* teacher-centered. A teacher-centered portion of a lesson can be inquiry-oriented by engaging students through modeling of investigative activities. Teachers can provide students with questions, data, and explanations; all the while discussing the reasoning processes that lead to justification for claims.

Choice "E" is not the best response because it suggests a good lesson must always be "hands-on." Hands-on does not ensure inquiry nor does it ensure students will connect the lesson to the real world. The teacher could engage students through questioning and other scenarios familiar to students, without needing to have students observe real fish – though this would be ideal.

[Note that for the same vignette, other or further questions could also be posed].

EXAMPLE ITEM 2: Alternative lessons on Force and Motion

Five teachers have different ways of introducing elementary students to the relationship between force and motion. However each of them plans to use a lesson activity involving a trolley with little friction; one student can sit in the trolley while another can pull it along by exerting force on the handle.



The goal is that students should gain a conceptual understanding of the scientific relationship between motion and force, viz. that an applied force will cause an object to *change* its motion, i.e. speed up or slow down. (Newton’s second law). (Leaving mass and change of direction till later).

The teachers devise different lesson plans. To best achieve recommended science learning goals, which of the following approaches is best?

A. Teacher Arthur: Starts by writing a main heading on the board: ‘Newton’s second law of motion ‘, then dictates the law (in conceptual terms) for students to write down. He then explains the law carefully, and illustrates it with a sketch of a trolley being pulled. Along the way he gives students the opportunity to ask questions. Finally he has students confirm the law experimentally, by checking what happens to a trolley when a person pulls it with a constant force.

B. Teacher Betty: First has students explore and observe what happens to the trolley when a steady force is applied to it. Then asks them to describe the kind of motion that occurs. She elicits possible questions of interest about forces and motions, and then asks for suggestions for a possible ‘law’ that would describe their observations. Having put forward a law or laws from discussion, students then test it by making predictions in various situations and trying it out. They finally write their own statements of the law they have generated.

C. Teacher Carl: Gives students freedom to try out anything they wish with the trolleys, intending that they should enjoy the hands-on activity and eventually discover on their own the relation between force and motion. He does not impose structure on the activity, nor tell students what to do, but is available for discussion. He does not give the 'correct answers' to their questions, but instead asks questions in return. He does not give students the 'correct' law at the end of the lesson, since this is not the only point of the lesson.

D. Teacher Donna: As a prelude to dealing with Newton's second law of motion, Donna introduces the term 'acceleration', defines it, and has students write it down. She then discusses the concept carefully, since students often have difficulty with it. Thereafter she states Newton's second law of motion, in the form 'acceleration is proportional to net force' and explains it. Students then confirm by pulling the trolley that a force produces acceleration, and that acceleration increases with the force.

E. Teacher Eric: He has several students in succession read paragraphs aloud from the textbook, since the text treats the topic very clearly and correctly. He calls on students to restate the law, and encourages them to ask questions. He then demonstrates the law using the example of the pulled trolley, having students perform the activity in front of the class, to confirm that the results agree with the textbook statement.

COMMENTS

Only options B and C represent inquiry approaches, but C is essentially unguided discovery. The other options present the conclusions of science first, then explain and confirm them, the antithesis of inquiry and investigation. Referring to the Inquiry-Item-Criteria (IIC), it will be seen that teaching option B addresses all five criteria (a – c), while the unstructured nature of option C makes it hard to know or ensure which criteria might be attained in a class. Lessons in the other options do not directly address the criteria except possibly criterion (c) to some extent in discussions.

A. This approach is completely non-inquiry, though organized and methodical. The lesson is a rhetoric of 'conclusions first', to paraphrase Schwab. Experiments are seen as confirmatory not investigative. Meets no IIC. Extreme right on the inquiry variations scale in Table 1.

B. A good inquiry approach, generating questions, ideas and concepts from exploration. Students propose a possible law from evidence and test it. Guided inquiry and investigation, appropriately structured, as advocated by standards. Meets all IIC. Left column on Table 1.

C. Unstructured and unguided discovery for the most part. It is unlikely that students will be able to make sense of the activities or reach the desired learning outcomes. Pure discovery is not advocated, and Klahr's research shows it to be ineffective. Not clear what IIC will be met. Off scale left on table 1.

D. Presents conclusions first, again the antithesis of inquiry. Moreover, difficult concepts (acceleration) are introduced and formally defined in a way that is unnecessary at this level and will likely interfere at this stage with developing the desired conceptual understanding. Meets no IIC or perhaps (e). Far right in Table 1.

E. This is a dreary passive class activity, though the teacher may be seeking to avoid 'teacher talking' to some extent. Approach is non-inquiry, little engaged. Experiments seen as confirming book knowledge rather than generating knowledge. Meets no IIC. Far right on Table 1.

Example 3: Anomalous results of a classroom investigation

Ms Lefevre is teaching her 3rd grade class about earthworms as a part of a unit on schoolyard ecology, focusing on the science content in the K-4 Life Science Content Standard of the NSES. Besides teaching her students about the basic needs of earthworms, she also wants to develop their skills of observing, investigating, recording and seeking patterns. The class had done a long interesting investigation on earthworms, with several groups making observations and taking data. Ms. Lefevre next brought the class together around the data chart, so that they could all look for patterns in their observational data, since she wanted her students to rely on evidence to develop their knowledge. During this analysis, one student pointed out that data collected by one group seemed to contradict data collected by another group.

What should Ms. Lefevre do in this situation?

A. Tell the students which of the two sets of data was correct and cross out the other data, so that none of the students would get the wrong ideas about earthworms.
B. Ask the students to suggest ways to resolve the issue, valuing any response that relied on evidence, e.g. re-examining recorded data or comparing procedures, repeating or taking more observations.
C. Ask everyone to look at the two data sets and to pick the one they thought was right. Then, have a show-of-hands vote to see which one should stay and which should be crossed off. This would ensure that the data that remained reflected the majority view.
D. Tell the students, “Since the data conflicts and we don’t know the answer, I will look this up and get back to you tomorrow.” Then, move on to look at the rest of the data with the class.
E. Ask the students to read through the topic resources again to see if they can find information that will resolve the dispute.

COMMENT

The correct response is B. This response most closely mirrors what scientists do when variations occur in data. They first recheck and rethink their observations, looking for sources of error. Then they often propose new observations under more closely prescribed conditions. In this way, they hope to gather enough data to see clear patterns.

Items A, D, and E essentially sideline the classroom inquiry to refer to an outside source, a poor choice when evidence or procedure is available to resolve the dispute.

Item C involves voting, which discounts certain data based on reasons other than the data itself. In science inquiry, all data is important initially, and data can only be discounted when error in observation or recording can be identified. Otherwise, the data counts, even if it seems not to fit or illustrate a clear pattern.