The Art of Questioning: Using Bloom’s Taxonomy in the Elementary School Classroom

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The Art of Questioning: Using Bloom's Taxonomy in the Elementary School Classroom

Summary
The stated goal of education is to help students acquire knowledge through comprehension. Because of its potential to promote comprehension and learning, questioning is one of the most influential teaching strategies. Academic research confirms that children develop critical thinking skills through teacher-facilitated questions (Ennis, 1996). Consequently, the purpose of this workshop is to provide pre-service teachers with an opportunity to reflect upon ways of using questioning techniques in the classroom to help challenge students' thinking. In this workshop, pre-service teachers will use a taxonomy for classifying educational objectives originally developed in 1956 by Benjamin Bloom and a group of educational psychologists. This taxonomy consists of six criteria: 1) knowledge, or the recall of information; 2) comprehension, or the understanding of concepts; 3) application, or problem solving; 4) analysis, in which students separate the material into its various components; 5) synthesis, in which students combine elements to form a new structure; and 6) evaluation, or judging the material. Using Bloom's Taxonomy (1956) and a more recent revision (Anderson, 2006), this workshop will demonstrate the value that meaningful questions have in the development of children's cognitive and critical thinking abilities. Specifically, participants will: (a) develop questionnaires for lessons; (b) reflect upon the rationale for certain types of questions; and (c) generate developmentally appropriate questions.

Keywords
Bloom's taxonomy, questioning techniques, critical thinking, pre-service teachers

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Gabriela Arias de Sanchez, The University of Prince Edward Island

SUMMARY
The stated goal of education is to help students acquire knowledge through comprehension. Because of its potential to promote comprehension and learning, questioning is one of the most influential teaching strategies. Academic research confirms that children develop critical thinking skills through teacher-facilitated questions (Ennis, 1996). Consequently, the purpose of this workshop is to provide pre-service teachers with an opportunity to reflect upon ways of using questioning techniques in the classroom to help challenge students’ thinking. In this workshop, pre-service teachers will use a taxonomy for classifying educational objectives originally developed in 1956 by Benjamin Bloom and a group of educational psychologists. This taxonomy consists of six criteria: 1) knowledge, or the recall of information; 2) comprehension, or the understanding of concepts; 3) application, or problem solving; 4) analysis, in which students separate the material into its various components; 5) synthesis, in which students combine elements to form a new structure; and 6) evaluation, or judging the material. Using Bloom’s Taxonomy (1956) and a more recent revision (Anderson, 2006), this workshop will demonstrate the value that meaningful questions have in the development of children's cognitive and critical thinking abilities. Specifically, participants will: (a) develop questionnaires for lessons; (b) reflect upon the rationale for certain types of questions; and (c) generate developmentally appropriate questions.

KEYWORDS: Bloom’s taxonomy, questioning techniques, critical thinking, pre-service teachers

LEARNING OBJECTIVES
By the end of this workshop, participants will be able to:
• develop an awareness of Bloom’s Taxonomy;
• recognize and articulate the characteristics of questions that target knowledge, comprehension and simple application;
• recognize and articulate the characteristics of questions that require complex thinking strategies such as analysis and synthesis;
• integrate developmentally appropriate questioning techniques into their classrooms; and
• apply pertinent questioning techniques to specific learning areas.

REFERENCE SUMMARIES

Ennis emphasizes that asking students questions is a way to build complex conceptualizations and foster critical thinking (p. 167). More specifically, Ennis examines the concept of critical thinking and proposes a set of criteria for teaching and assessing this "disposition" (p. 166). Ennis’ ideas are grounded in the notion that critical thinking is a disposition that can only be assessed and challenged in educational settings if individuals display it through different behaviors. As a result, Ennis builds upon previous studies
conducted by Perkin, Jay and Tishman (1993) and offers a comprehensive list of dispositions that critical thinkers will have an inclination towards. Examples of these dispositions include: seeking and offering rationales, being reflective, and considering other individuals viewpoints (p. 171). Depending on the disposition, Ennis advises that critical thinking must be assessed differently. Although Ennis recognizes that further research is required to further explore how to assess whether or not students are thinking critically, Ennis does propose a tentative solution by suggesting that teachers use a wider variety of assessment techniques such as multiple choice, performance-based assessment and open-ended multiple item tools (p.175).

This provides a comprehensive overview of why it is so important to challenge students' critical thinking skills and why teacher-posed questions are effective in promoting student comprehension. In addition, this study provides the reader with a few examples of how to assess critical thinking as well as examples of challenges that educators may encounter. Furthermore, the study also invites readers to think and further explore other ways of assessing and challenging critical thinking. For these reasons, this article is an excellent resource in introducing the topic of this workshop and can be used to promote a conversation about why questions are so important in developing critical thinking skills.


This study describes the strengths and weakness of both the original taxonomy developed by Bloom (1956) and the revised version conducted by Anderson (2001). According to Amer (2006), theories of education have evolved significantly since the introduction of Bloom’s Taxonomy (1956); thus, it is imperative to revise how its original framework should be considered within new teaching paradigms. The study uses tables to summarize the differences between both versions to distinguish their similarities and differences. Amer (2006) also proposes a clear rationale for why these taxonomies should be considered in teaching practices on the basis that they further develop meaningful learning.

This paper is an excellent resource that introduce both versions of Bloom’s Taxonomy and provides clear descriptions of current educational paradigms, many of which pre-service teachers will already be familiar with. In particular, the two cognitive process dimensions summarized in Table 5 (p. 224) are highly relevant in the development of teaching practices.


This paper considers Anderson's revision (2006) of Bloom's Taxonomy (1956). Specifically, Noble (2004) focuses on how these taxonomies could be linked to differentiated instruction such as Gardner's theory of multiple intelligences (1999). The study combines the typologies of both approaches, Bloom's (1956) and Anderson's (2006) taxonomies, to
provide a planning tool for curriculum differentiation. Noble (2004) reports that two teachers in two different elementary schools who used this planning tool stated that the tool was successful in giving them more options to think about how to challenge students' critical thinking and helping them design lessons for students who need a more differentiated teaching approach.

This article can generate discussion about an issue that teachers will encounter in real life: how to frame and lead differentiated instruction. By describing some teachers’ experiences with the outcomes of the study, this article provides many different examples that could be included in this workshop, particularly in relation to the applicability of Bloom’s Taxonomy.

### CONTENT AND ORGANIZATION

<table>
<thead>
<tr>
<th>Duration (min)</th>
<th>Subject</th>
<th>Activity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Introduction</td>
<td>Welcome participants to the workshop and allow for introductions. &lt;br&gt; To introduce participants to the value of questioning, show participants a slide of one of Picasso’s paintings. Invite participants to generate a series of questions that they might ask their students if they were teaching a lesson on Picasso’s art. Ask participants to share their questions with the larger group.</td>
<td>Introduce participants to the importance of the art of effective questioning.</td>
</tr>
<tr>
<td>15</td>
<td>Presentation: Convergent vs. Divergent Questions and Bloom’s Taxonomy</td>
<td>Begin by asking the group why questioning students is important. Allow time for students to contribute their responses. &lt;br&gt; Introduce the difference between convergent and divergent question types. Consult Appendix A for an example of this slide. &lt;br&gt; Introduce Bloom’s Taxonomy (1956) and Anderson’s revision (2006). Consult Appendix B for an example of this slide.</td>
<td>Familiarize participants with the difference between divergent and convergent questions and introduce them to Bloom’s Taxonomy (1956) and Anderson’s revision (2006).</td>
</tr>
<tr>
<td>20</td>
<td>Discussion</td>
<td>Utilizing the “think-pair-share” method, invite participants to choose a partner and revise the questions the questions they</td>
<td>Encourage participants to think about how to use Bloom’s taxonomy in developing specific</td>
</tr>
<tr>
<td>Time</td>
<td>Group Activity</td>
<td>Instruction</td>
<td>Notes</td>
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<tr>
<td>20</td>
<td><strong>Group Reading and Discussion</strong></td>
<td>Divide participants into groups of four. Provide each group with a summary of an elementary school curriculum activity. Ask participants to read the activity and solve the accompanying questionnaire. Consult Appendices C, D, E, F, G and H for more information regarding this activity. When participants have finished, invite them give themselves a number of 1 through 4, respectively, so that each group member has a different number.</td>
<td>Have students apply what they have learned about developing effective questions using Bloom’s Taxonomy to case studies of educational curricula.</td>
</tr>
<tr>
<td>40</td>
<td><strong>Group Presentations and Discussion</strong></td>
<td>Divide participants into new groups of four based on the self-assigned number from the previous activity. Each group should have one participant from each of the reading groups from the previous activity. Invite each participant to present the activity that he/she took part in the previous group to the new group. Have participants share not only the basis of the activity but also the questions, responses and discussions that emerged. When all groups have presented their activities to each other, have each group summarize the key findings on a flip chart. Invite each group to designate one participant to present these findings to the larger group.</td>
<td>In groups, have participants develop a summary of the key findings of each curriculum activity.</td>
</tr>
</tbody>
</table>
| 10 | Wrap up | Invite participants to share their final thoughts.  
Conclude the presentation by sharing a list of outcomes that some teachers have reported about their experience with questioning students. Consult Appendix H for an example of this slide. | Conclude the workshop by inviting questions and leaving participants with a list of outcomes to consider. |

**Total Time:** 120 minutes

**ADDITIONAL REFERENCES**


APPENDIX A: The Art of Questioning

The Art of Questioning

Convergent questions
One way answer
Test knowledge of concrete facts

Divergent questions
Have no single correct answer
Test the students’ ability to synthesize information, offer opinions or create hypotheses based on their knowledge
APPENDIX B: Bloom’s Taxonomy

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>THINKING OBJECTIVES</th>
<th>QUESTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNOWLEDGE</td>
<td>Remembering. Recalling (not necessary understanding).</td>
<td>CONVERGENT</td>
</tr>
<tr>
<td>COMPREHENSION</td>
<td>Understanding the material being communicated without necessarily relating it to anything else.</td>
<td>CONVERGENT</td>
</tr>
<tr>
<td>APPLICATION</td>
<td>Using a general concept to solve a problem with only one possible answer.</td>
<td>CONVERGENT</td>
</tr>
<tr>
<td>ANALYSIS</td>
<td>Breaking something down into its parts.</td>
<td>DIVERGENT</td>
</tr>
<tr>
<td>SYNTHESIS</td>
<td>Creating something new by combining different ideas.</td>
<td>DIVERGENT</td>
</tr>
<tr>
<td>EVALUATION</td>
<td>Judging the merits of ideas, offering opinions</td>
<td>DIVERGENT</td>
</tr>
</tbody>
</table>
APPENDIX C: Handout on “Questions in the Science Classroom”

The 5Es instructional model gives teachers an opportunity to encourage children to exercise their innate curiosity, learn about the natural world, and develop problem-solving skills. This model of instruction was developed by the BSCS group (Biological Sciences Curriculum Study, 1989).

There are five phases in the 5Es model:

- **Engagement**: Teachers engage students with questions about objects, organisms, and events in the environment and provide background knowledge and conceptions.
- **Exploration**: Students plan and conduct investigations to gather evidence to answer the questions.
- **Explanation**: Building on students’ explorations and explanations, teachers formally present labels, concepts and principles. Students, guided by the teachers, use new knowledge to construct scientific explanations and answer initiating questions.
- **Elaboration**: Students apply new understanding to new problems.
- **Evaluation**: Teachers use formative and authentic assessment to assess young children’s new knowledge and abilities.

Using the 5Es model, teachers prepare themselves in advance to provide children with chances to explore specific concepts and questions. Table 1, below, provides an example of a science lesson that could be adapted from preschool through third grade.

<table>
<thead>
<tr>
<th>5E Phase</th>
<th>Question Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engage</strong></td>
<td>Ask questions about objects, organisms and events in the environment.</td>
</tr>
</tbody>
</table>
| For instance, a teacher could give children real ice cream to observe. | • *Knowledge*: Have you ever eaten ice cream?  
• *Comprehension*: Describe the taste of the ice cream. (Comprehension)  
• *Knowledge*: Name the ingredients you think the ice cream is made from.  
• *Analysis*: How do you think ice cream is made? |

Objectives

1. Students will make ice cream using basic household ingredients and compare its taste with store bought ice cream.

2. Students will observe the chemical reactions that occur when making the ice cream.

*Note*: Students will have access only the following materials: milk, cream, or half & half; vanilla extract or chocolate syrup; sugar, ice, salt, zip-close plastic bags (large and small) and newspaper.
<table>
<thead>
<tr>
<th><strong>Explore</strong></th>
<th><strong>Explain</strong></th>
</tr>
</thead>
</table>
| Ask questions that encourage students to gather evidence that will help them answer the questions posed. | • *Synthesis:* How can you make ice cream with the ingredients?  
• *Synthesis:* Think of several ways to make ice cream. |
| **Elaborate** | **Evaluate** |
| Ask questions that encourage students to apply new understanding to new problems. | • *Analysis:* Why are the liquid ingredients turning into ice cream?  
• *Knowledge:* How long does it take to turn ingredient into ice cream?  
• *Analysis:* What does the salt do in the ice cream making process? |

For instance, a teacher could bring all of the ingredients used to make ice cream. Encourage students to put the ingredients into a sandwich sized zip-lock bag. Put three of four of the students’ bags into a larger zip-lock bag that is half-filled with ice. Shake the bag for 5 minutes.

For instance, students could take a fieldtrip to an ice cream factory where they learn about how the ice cream manufactures ice cream.

- Continuous (formative) assessment
- Assess performance on the activity sheet (best suited for older children)
- Encourage oral explanations and prediction.

Paragraphs and examples extracted and adapted from:

**Workshop Learning Activity**

1. Develop an example of a science experiment.

2. Use the 5Es model to develop convergent and divergent questions that you could ask your students to stimulate their thinking and scientific learning. What levels of thinking (Bloom’s/Anderson’s taxonomy) could be promoted by these questions?
APPENDIX D: Handout on “One-to-One” Interview

One-to-one interviewing is one of the most powerful ways of exploring young children’s thinking. Literature suggests that one of the strengths of the interview method is that it can be used to assess both cognitive and affective aspects of children’s understandings (Dunphy 2005, as cited in Phillips & Friedman, 2009).

Scenario
To integrate a previous lesson on healthy eating with mathematical concepts of sorting and addition, a grade one teacher used a video game approach. The teacher asked her class to imagine that they were going to create a video game. Using the smart board located in the room, the teacher placed a picture of a famous character and a large assortment of pictures of food on both sides of the smart board. The teacher then asked students to develop a scoring system for the game. Students sorted the items according to which foods would earn a lot of points, a few points, or no points at all. They also added a category for unhealthy food items that would result in a deduction of points. Children then played the game in groups of two. In a follow up activity the teacher used the video game scoring system to interview and assess the students’ understanding of operations and sorting.

Workshop Learning Activity
Suppose that you developed the activity described for your class. A few days later, you want to individually assess each student’s understanding of addition and sorting. Therefore, you decide to interview each student using the same game-scoring activity.

1. What convergent and divergent questions could you ask during these one-to-one interviews? What levels of thinking could be promoted by these questions? (Bloom’s taxonomy).

2. What questions could you ask to encourage students’ metacognition? (Anderson’s taxonomy).

3. What do you think about one-to-one interviews? What are the strengths and weakness of this approach?

4. Describe other scenarios where you could use one-to-one interviews.
APPENDIX E: Handout on “Wh-Questions”

When children have previously experienced an event or an event is going on-going, research suggests that open-ended elaborative wh-questions such as: what? why?; and how? are effectively (Griffin, 2004). Such questions encourage children to focus their attention on changes they may notice and point out obstacles.

In general, the aim of elaborative questions is to:
- focus the children’s attention on what is available for them to learn;
- encourage children to share what they understand about any changes to the experience that they have noticed; and
- promote problem solving.

**Workshop Learning Activity**

As a teacher, you are very much aware that these types of questions promote critical inquiry by facilitating a way for children to express what are they thinking.

Imagine you are visiting a cultural site with your class. Imagine the context, the history, the science embedded in the scenario.

1. What questions could you ask to promote elaborative conversations?

2. What levels of thinking (Bloom’s taxonomy/ Anderson’s taxonomy) could be promoted by these questions?

3. In what other instances you use questions that promote elaborative conversations? In your opinion, are these mostly convergent or divergent questions? Justify.
APPENDIX F: Handout on “The ART of Questioning”

A picture may be worth a thousand words but these words can remain unsaid or misunderstood when adults do not attend to their development. Beyond fostering the young children’s artistic development, teachers must also guide children’s aesthetic development—verbal and visual literacy—in the aesthetic domain. Otherwise, their art may be misinterpreted or neglected and the young artists’ meaning will never be communicated.

According to Johnson (2008) teachers can ask children questions about:
1. **Ideas**: Tell me/us more about your piece?
2. **Process**: Could you tell me how you built it/painted it/coloured it?
3. **Materials**: What materials did you use?
4. **Knowledge**: What kinds of shapes did you use? Did you use shapes like Henri Matisse? Are you using colors like Renoir?

**Teacher Tips**
- Use correct art terms.
  - "You made green, a secondary color"
- Ask convergent questions that help children recognize what they already know.
  - "What color did you make?"
  - "What artist did you say this painting reminded you of?"
- Ask divergent questions that are open-ended and promote discovery.
  - "What are some materials (media) you could use in your farm picture?"
  - "What ideas do you have about this collage?"
  - "What can you find to use in our scraps box?"
- State a problem and help children find a solution.
  - "It’s hard to see the blue lines on blue paper. I wonder if it would be easier to see your drawing if you used a different color crayon. What other colors could you use that would show up on blue paper?"
- Model new art concepts and processes.
  - "I want a lighter tint of blue for my sky. I’ll add more white to my paint. Now it’s the shade of blue I wanted."
Workshop Learning Activity
Imagine you have developed a project about Van Gogh for your class. One of the activities consists of children painting the famous painting “Sunflowers”, depicted below.

1. What questions could you ask children about their ideas, their knowledge, the painting process?
2. What levels of thinking (Bloom’s taxonomy/Andersons’ taxonomy) could be promoted by these questions?
3. Do you think you could use these questions in other learning areas? Why? Why not?

Paragraphs and examples extracted from:

Image of Van Gogh’s “Sunflowers” retrieved from:
http://www.vangoghgallery.com/painting/sunflowerindex.html
Wrap up

Questions?
Main thoughts?

In previous iterations teachers said, for example:

- one-to one interviews could be surprising
- they found themselves asking too many questions
- they give children little time to think an answer
- sometimes they struggle to explain the questions
- they need to improve the questions they ask
- sometimes they are surprised to what children know