2.4.15 Writing Critical Thinking Questions

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Much educational research documents that, in order to achieve real understanding and knowledge that persists over time, learners must actively restructure the information they absorb. In this restructuring, the new knowledge must be integrated with prior knowledge, experiences, and beliefs; contradictions must be identified and resolved; and generalizations and implications must be articulated and applied in solving problems. Guided-inquiry activities help students with this restructuring by employing a learning cycle consisting of exploration, concept formation, and application. Critical thinking questions are at the heart of these activities and serve to guide students in the exploration that leads them to inventing or developing an understanding of the relevant concepts (***3.3.3 Process-Oriented Guided-Inquiry Learning***).

Role of Critical Thinking

Critical thinking has been defined in several ways (***2.2.5 Overview of Critical Thinking***). Some definitions are synonymous with *thinking critically*, while others appear to be synonymous with *thinking analytically*.

In 1962, Robert Ennis defined 12 aspects of critical thinking in terms of assessing statements. In this context, critical thinking involves being challenging and skeptical, i.e. thinking critically: for example, by identifying ambiguities and assumptions, finding contradictions, examining the logic leading to a conclusion, judging whether a statement is overly general, critiquing the application of principles and concepts, deciding whether a definition is adequate, and determining whether a statement made by an alleged authority is relevant or believable (Hoaglund, 1995).

Critical thinking also can be thought of as a process for actively exploring situations by asking relevant questions in order to decide what to believe or what to do. In this context, critical thinking means thinking analytically. "In fact, the ability to ask appropriate and penetrating questions is one of the most powerful thinking tools you possess, although many people do not make full use of it. Active learners explore the learning situations they are involved in with questions that enable them to understand the material or task at hand, and then integrate this new understanding into their knowledge framework. In contrast, passive learners rarely ask questions. Instead, they try to absorb information like sponges, memorizing what is expected and then regurgitating what they memorized on tests and quizzes." (Chaffee, 2004)

Sequencing of Questions

Critical thinking questions are used to explore models in learning activities guide inquiry through multiple levels in Bloom's taxonomy, and help students recognize how such questions aid learning (***2.4.14 Designing Process-Oriented Guided-Inquiry Activities***). Guided-inquiry activities typically require students to answer 6-10 critical thinking questions, broken down as follows: 2-3 directed questions, followed by 3-6 convergent questions, followed by one divergent question. These are called *Key Questions* because they serve to unlock the knowledge in a guided-inquiry activity for the students (Hanson, 2006).

In a process-oriented classroom, student teams usually work at different rates, and there can be a large variance in the amount of time required to complete an activity. Thoughtful use of critical thinking questions can lessen these differences and make it easier for faculty to manage classroom learning. *Directed questions* are placed first because they build a strong foundation and prevent teams from going off on tangents. A *divergent question* is placed at the end as an "equalizer" for faster teams who reach this question well ahead of the others. Some teams will get further into the divergent question than others. It is important to reward or acknowledge the efforts of the faster teams for their additional work, especially if it is of high quality.

Criteria for selecting and sequencing critical thinking questions include:

- **Relevant**: must help students meet performance criteria for activity
- **Growth-Oriented**: must promote growth for learners at multiple levels of development
- **Logical**: must be thoughtfully sequenced from lower- to higher-level questions

Directed Questions

Directed questions focus on Level 1 knowledge (***2.2.1 Bloom's Taxonomy—Expanding its Meaning***), consisting of information and facts. Directed questions point students to the information they need to start the activity. Such questions often begin with *who, what, when, where*, and *which*. The answers can be found by examining the model presented in the activity, using the information resources listed, or by drawing on personal experience and prior knowledge and activities. Such questions have a definite answer and build the foundation for more challenging questions.

Criteria for writing directed questions include:

- **Preparatory**: measure readiness for the learning activity
- **Exploratory**: require the learner to use the resources

needed for the activity (e.g., the model, reading, lectures, and real-life experiences).

- **Accessible**: motivate learners through initial success
- **Foundational**: deconstruct misconceptions and build infrastructure for future learning

Convergent Questions

Convergent questions build Level 2 knowledge (understanding of concepts) and help students elevate their knowledge to Level 3 (applying knowledge to solve problems) (***2.2.2 Elevating Knowledge from Level 1 to Level 3***). Convergent questions require students to organize, interpret, analyze, and synthesize. They many have more than one correct answer, and the level of difficulty progresses within a sequence of questions. A good convergent question makes important connections, links concepts together, leads to better understanding, and requires that students reach conclusions.

Criteria for writing convergent questions include:

- **Challenging**: answers are not directly available in the resources (e.g., in the model, readings, lectures, and real-life experiences)
- **Rich**: allow for more than one correct answer or approach
- **Integrative**: make links between key information in the resources

Convergent questions emphasize organization and interpretation, and ask students to understand key characteristics of new concepts or steps within a process. Such questions often require analysis, asking students to deconstruct a model to identify its components, describe their relationship, and consider alternatives. Examples include:

- What are the similarities and differences between….?
- What is the effect or consequence of ….?
- Why is it necessary to….?
- What idea explains….?

Convergent questions also can require synthesis, asking students to combine features in the model, identify the main idea, conclude which idea is better and why, and which idea is supported by the model. Examples include:

- What is the evidence that supports (contradicts)…?
- What trend is shown by….?
- How might x influence…?
- How would you summarize….?

Divergent Questions

Divergent questions send students in new and interesting directions. They may have no right or wrong answer, but require students to ponder, explore, generalize, and expand their current knowledge. Divergent questions require the highest level of thinking and produce outcomes and conclusions that vary among learning teams and individuals. They help identify holes in knowledge and test understanding by challenging the knowledge structure that was built. They can be used to help students confront common misconceptions. Criteria for writing divergent questions include:

- **Difficult**: require the learner to go beyond the performance criteria for the activity
- **Open-ended**: encourage learners to travel down different paths of inquiry
- **Validating**: motivate learners to test and generalize boundary conditions
- **Deep**: are possible research questions

Divergent questions are points of departure for wider application or debate. Examples include:

- What do you predict would happen if….?
- How can x be used for….?
- What is a situation that illustrates…?
- What would you recommend for….?

Concluding Thoughts

No matter how inspired you might be when you compose critical thinking questions, no matter how pleased with the results, you will benefit from taking time to review, refine, and resequence your questions and have them reviewed by a student and a faculty colleague (***2.4.17 Assessing Learning Activities***). You should also be aware of the message that the "white space" surrounding each question communicates about your expectations for response. Less space with bullets encourages students to work quickly toward a quantitative goal. More space encourages justification and debate. To the extent that critical thinking questions are an essential part of a learning activity, don't distract students with lots of other information and instructions.

References

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