

Reflective Thinking: RT

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What is reflective thinking?

- **The description of reflective thinking:**

Critical thinking and reflective thinking are often used synonymously. *Critical thinking* is used to describe:

"... the use of those cognitive skills or strategies that increase the probability of a desirable outcome...thinking that is purposeful, reasoned and goal directed - the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task. Critical thinking is sometimes called directed thinking because it focuses on a desired outcome." Halpern (1996).

Reflective thinking, on the other hand, is a part of the critical thinking process referring specifically to the processes of analyzing and making judgments about what has happened. Dewey (1933) suggests that reflective thinking is an active, persistent, and careful consideration of a belief or supposed form of knowledge, of the grounds that support that knowledge, and the further conclusions to which that knowledge leads. Learners are aware of and control their learning by actively participating in reflective thinking – assessing what they know, what they need to know, and how they bridge that gap – during learning situations.

In summary, *critical thinking* involves a wide range of thinking skills leading toward desirable outcomes and *reflective thinking* focuses on the process of making judgments about what has happened. However, reflective thinking is most important in prompting learning during complex problem-solving situations because it provides students with an opportunity to step back and think about how they actually solve problems and how a particular set of problem solving strategies is appropriated for achieving their goal.

Characteristics of environments and activities that prompt and support reflective thinking:

- Provide enough wait-time for students to reflect when responding to inquiries.
- Provide emotionally supportive environments in the classroom encouraging reevaluation of conclusions.
- Prompt reviews of the learning situation, what is known, what is not yet known, and what has been learned.
- Provide authentic tasks involving ill-structured data to encourage reflective thinking during learning activities.
- Prompt students' reflection by asking questions that seek reasons and evidence.
- Provide some explanations to guide students' thought processes during explorations.
- Provide a less-structured learning environment that prompts students to explore what they think is important.
- Provide social-learning environments such as those inherent in peer-group works and small group activities to allow students to see other points of view.

- Provide reflective journal to write down students' positions, give reasons to support what they think, show awareness of opposing positions and the weaknesses of their own positions.
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- **Links to descriptions of reflective thinking activities in use with middle school kids:**
 - Recommendations for prompting reflective thinking in the classroom:
 - <http://www.cotf.edu/ete/teacher/reflect.html>
 - Examples of lesson plans that have been revised to encourage reflective thinking in students, e.g., prompting to compare what they know to what they don't know and actively make modifications to their conceptions:
 - <http://www.criticalthinking.org/k12/k12class/4-6/skeleton.nclk>
 - <http://www.criticalthinking.org/k12/k12class/6-9/bugs.nclk>

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- **Why is reflective thinking important?**

Modern society is becoming more complex, information is becoming available and changing more rapidly prompting users to constantly rethink, switch directions, and change problem-solving strategies. Thus, it is increasingly important to prompt reflective thinking during learning to help learners develop strategies to apply new knowledge to the complex situations in their day-to-day activities. Reflective thinking helps learners develop higher-order thinking skills by prompting learners to a) relate new knowledge to prior understanding, b) think in both abstract and conceptual terms, c) apply specific strategies in novel tasks, and d) understand their own thinking and learning strategies.

- **Links to more information on reflective thinking:**
 - Critical or reflective thinking:
 - http://www.mdk12.org/practices/good_instruction/projectbetter/thinkingskills/ts-17-20.html
 - Reflective thinking:
 - <http://www.algonquinc.on.ca/edtech/gened/reflecti.html>

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Reflective thinking and middle school kids:

- **How to prompt reflection in middle school kids:**

It is important to prompt reflective thinking in middle school children to support them in their transition between childhood and adulthood. During this time period adolescents experience major changes in intellectual, emotional, social, and physical development. They begin to shape their own thought processes and are at an ideal time to begin developing thinking, learning, and metacognitive strategies. Therefore, reflective thinking provides middle level students with the skills to mentally process learning experiences, identify what they learned, modify their understanding based on new information and

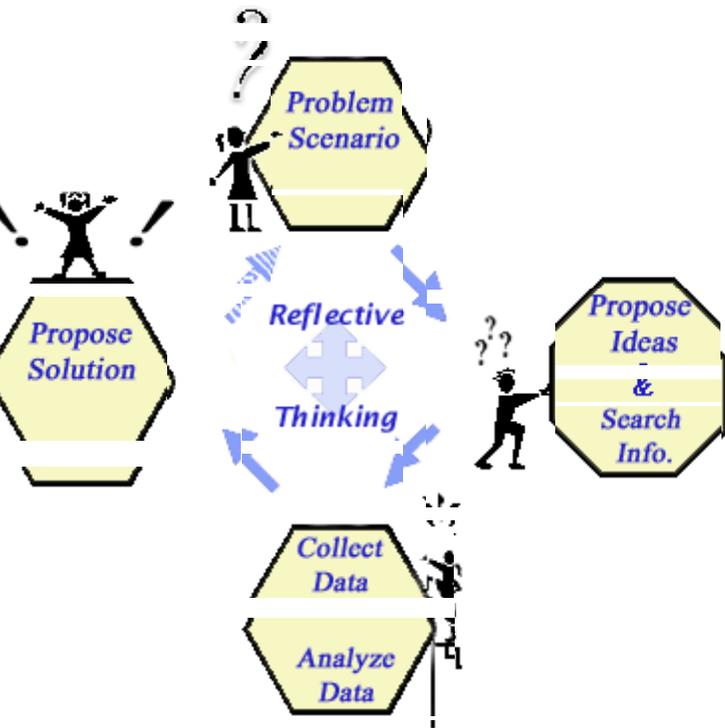
experiences, and transfer their learning to other situations. Scaffolding strategies should be incorporated into the learning environment to help students develop their ability to reflect on their own learning. For example,

- Teachers should model metacognitive and self-explanation strategies on specific problems to help students build an integrated understanding of the process of reflection.
- Study guides or advance organizer should be integrated into classroom materials to prompt students to reflect on their learning.
- Questioning strategies should be used to prompt reflective thinking, specifically getting students to respond to *why*, *how*, and *what* specific decisions are made.
- Social learning environments should exist that prompt collaborative work with peers, teachers, and experts.
- Learning experiences should be designed to include advice from teachers and co-learners.
- Classroom activities should be relevant to real-world situations and provide integrated experiences.
- Classroom experiences should involve enjoyable, concrete, and physical learning activities whenever possible to ensure proper attention to the unique cognitive, affective, and psychomotor domain development of middle school students.

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How does **KaAMS** support reflective thinking?

- **KaAMS** model of PBL and its relationship to reflective thinking:



When students are faced with a perplexing problem, reflective thinking helps them to become more aware of their learning progress, choose appropriate strategies to explore a problem, and identify the ways to build the knowledge they need to solve the problem. The **KaAMS** model of PBL incorporates various components to prompt students' reflective thinking during the learning process. The lesson plans:

- Provide teacher questions designed to prompt students to identify and clarify overall and subordinate problems.
- Provide many opportunities to engage students in gathering information to look for possible causes and solutions.
- Provide ideas and activity sheets to help students evaluate the evidence they gather.
- Provide questions that prompt students to consider alternatives and implications of their ideas.
- Provide questions and activities that prompt students to draw conclusions from the evidence they gathered and pose solutions.
- Provide opportunities for students to choose and implement the best alternative.
- Encourage students to monitor and reevaluate their results and findings throughout the entire unit.

- **KaAMS incorporates prompts and scaffolding suggestions to promote reflective thinking by:**
 - Structuring lesson plans to support reflective thinking.
 - Providing lesson components that prompt inquiry and curiosity.
 - Providing resources and hand-on activities to prompt exploration.
 - Providing reflective thinking activities that prompt students to think about what they have done, what they learned, and what they still need to do.
 - Providing reflection activity worksheets for each lesson plan to prompt students to think about what they know, what they learned, and what they need to know as they progress through their exploration.

Links to additional information on critical and reflective thinking:

- Reflective thought, critical thinking (Eric digest)
http://www.indiana.edu/~eric_rec/ieo/digests/d143.html
 - Reflective thinking, John Dewey and PBL
<http://www.imsa.edu/~bernie/dewey.html>
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A Selected Reflective Thinking Bibliography:

Book:

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- Halpern, D. F. (1996). Thought and knowledge: an introduction to critical thinking (3rd ed.). Mahwah, NJ: L. Erlbaum Associates.

Selected Article:

- Lin, X., Hmelo, C., Kinzer, C. K., & Secules, T. J (1999). Designing technology to support reflection, Educational Technology Research & Development, pp. 43-62.

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KaAMS: A PBL environment facilitating reflective thinking

Primary Presenters: Tiffany Koszalka, Ph.D.
Hae-Deok Song, Graduate Student
Barbara L. Grabowski, Ph.D.

Primary Presenter: Tiffany A. Koszalka, Ph.D.
Syracuse University
336 Huntington Hall
Syracuse, NY 13244
315 443 3703

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The ability to reflect while exploring the problem is necessary to maintain the essence of effective PBL practice. Some articles have described the development of learning environments that facilitate reflective thinking. However, these applications don't systematically consider comprehensive elements. The purpose of this study was to systematically develop a PBL environment that supports reflective thinking. We will present KaAMS PBL environment to show how reflective thinking support strategies can be incorporated in a PBL lesson.

Abstract: (2000 words)

KaAMS: A PBL environment facilitating reflective thinking

The ability to reflect while exploring the problem is necessary to maintain the essence of effective PBL practice. Some articles have described the development of learning environments that facilitate reflective thinking. However, these applications don't systematically consider comprehensive elements. The purpose of this study was to systematically develop a PBL environment that supports reflective thinking. We will present KaAMS PBL environment to show how reflective thinking support strategies can be incorporated in a PBL lesson.

Reflective thinking has been identified as an important component in the practice of education. It provides learners with an opportunity to correct misconceptions and fill in gaps by helping them to think about what they are doing and why they are doing it. Thus, many researchers argue that reflective processes are essential to the quality of learning (Barab & Duffy, 1999; Lin, Hmelo, Kinzer, & Secules, 1999; Shon, 1987). Reflective thinking is especially helpful in solving complex tasks, because it helps learners to identify facts, formulas, and theories that are relevant for the solution of an ill-defined problem (King & Kitchener, 1994). In recent years, much attention had been dedicated to Problem-Based Learning (PBL) based on constructivistic views of learning. Because the learning in PBL starts from an ill-structured problem in which there is no single solution, learners are inclined to be disoriented. Therefore, the ability to reflect while exploring the problem is necessary to maintain the essence of effective PBL practice. Reflective thinking is particularly important to young children who are in the state of developing abstract thinking because "it is central to acquiring best practice, steadily extending knowledge, refining one's evolving philosophy" (The National Association for the Education of Young Children, 1996).

How then, do we support reflective thinking in a PBL learning environment for middle school kids? Previous studies identified several variables that affect reflective thinking, such as teacher questioning and journal writing (Andrusyszyn & Daive, 1997; Barrow, 1998; Lin, Hmelo, Kinzer, & Secules, 1999; Moon, 1999). Based on these findings, some articles have described the development of learning environments that facilitate reflective thinking. However, these applications don't systematically consider comprehensive elements that influence the reflective thinking but rather include only a few elements. Therefore, systematic consideration of supporting reflective thinking is needed to make a more meaningful student-centered PBL learning environment.

The purpose of this study was to systematically develop a PBL environment that supports reflective thinking. For this purpose, we identified the main factors that facilitate reflective thinking (Koszalka, Song, & Grabowski, 2001). Students reported that they perceived a teacher, a learning environment, and a tool as meaningful factors that affect their reflective thinking. We also identified the elements that can facilitate reflective thinking in each derived factor. Based on our findings, we developed a web-enhanced science problem environment that facilitates reflective thinking, KaAMS (Kids as Airborne Mission Scientists). We will present the model and strategies of KaAMS to show how reflective thinking support strategies can be incorporated in a PBL lesson. The main factors and strategies used in order to support reflective thinking in KaAMS are as follows:

The teacher factor: Using reflective questions

Educational experience that encourages reflective thinking should engage students to think critically about the process of learning. A common strategy that fosters reflective thinking is the use of thoughtful questioning. We included questions that prompt reflective thinking in KaAMS. We will present reflective prompting questions included in KaAMS and teacher questions collected during classroom observation.

The learning environment factor: Developing an active learning environment

An active learning environment is also important in prompting reflective thinking during PBL. To make an active learning environment, we incorporated various strategies in KaAMS. Those strategies included

- Using an ill-structured, authentic, and complex problem: Ill-structured, authentic, and complex tasks are known to promote reflective thinking. These features of the task help students think reflectively because they come from real-world experiences, have no single formula for conducting an investigation to resolve the problem, and require more information to understand the problem situation (Stepien & Pyke, 1997). We will present an authentic and ill-structured problem scenario from KaAMS.
- Ownership: Reflective thinking is facilitated when students feel they are responsible for their learning. We will present a simulation role-playing strategy developed in order to provide ownership in KaAMS.
- Small group learning: Working in a small group provides the opportunity to look at multiple perspectives. We will present various small group learning strategies used in KaAMS.

The tool factor: Integrating reflective thinking supportive tools

Various tools such as journal writing give the students a channel for their reflection on the learning experience. Through the work of writing, students can identify errors in the process of learning. We will present examples of reflective journals used in KaAMS as well as reflective thinking checklists developed to help monitor the learning progress.

The first two learning modules of KaAMS were implemented last year and the last two learning modules are being tested now in several rural middle schools. We will present the KaAMS learning environment and examples collected from classroom implementation.

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