

# Inquiry in Mathematics

*This document explains the role of inquiry in math and discusses effective questioning for inquiry in math.*

Supporting Kindergarten

April 2011

## **Inquiry**

Inquiry learning provides children with opportunities to build knowledge, abilities, and inquiring habits of mind that lead to deeper understanding of their world and human experience. The inquiry process focuses on the development of compelling questions, formulated by teachers and children, to motivate and guide inquiries into topics, problems, and issues related to curriculum content and outcomes.

Inquiry is more than a simple instructional method. It is a philosophical approach to teaching and learning, grounded in constructivist research and methods, which engages children in investigations that lead to disciplinary and transdisciplinary understanding.

Inquiry builds on children's inherent sense of curiosity and wonder, drawing on their diverse backgrounds, interests, and experiences. The process provides opportunities for children to become active participants in a collaborative search for meaning and understanding. Children who are engaged in inquiry:

- construct deep knowledge and deep understanding rather than passively receiving it
- are directly involved and engaged in the discovery of new knowledge
- encounter alternative perspectives and conflicting ideas that transform prior knowledge and experience into deep understandings
- transfer new knowledge and skills to new circumstances
- take ownership and responsibility for their ongoing learning and mastery of curriculum content and skills.

(Adapted from Kuhlthau & Todd, 2008, p. 1)

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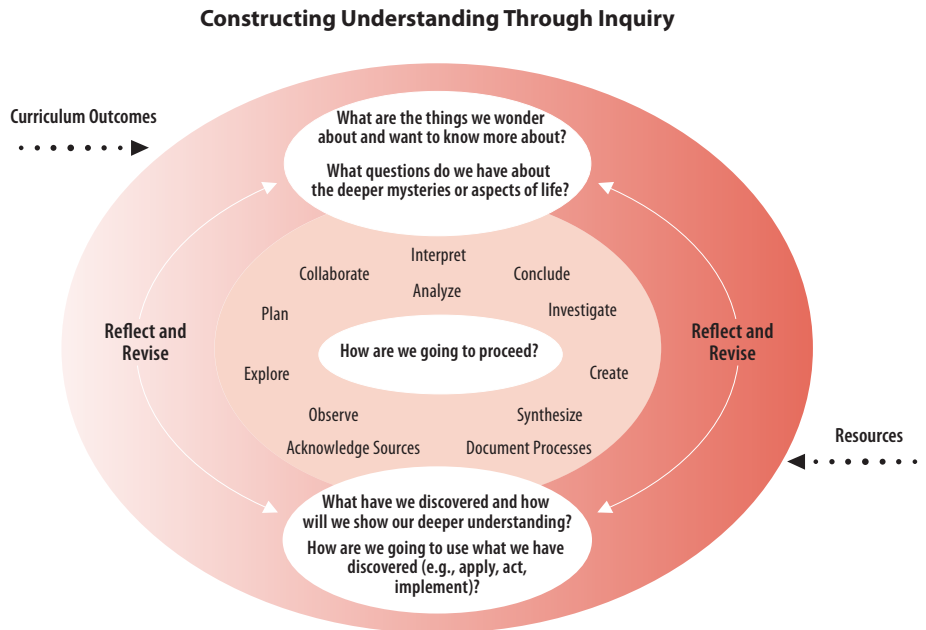
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Inquiry learning is not a step-by-step process, but rather a cyclical process, with various phases of the process being revisited and rethought as a result of students' discoveries, insights, and co-construction of new knowledge. The following graphic shows various phases of this cyclical inquiry process.



Inquiry prompts and motivates children to investigate topics within meaningful contexts. The inquiry process is not linear or lock-step, but is flexible and recursive. Experienced inquirers will move back and forth through the cyclical process as new questions arise and as children become more comfortable with the process.

Well formulated inquiry questions are broad in scope and rich in possibilities. They encourage children to explore, gather information, plan, analyze, interpret, synthesize, problem solve, take risks, create, conclude, document, reflect on learning, and develop new questions for further inquiry.

In mathematics, inquiry encompasses problem solving. Problem solving includes processes to get from what is known to discover what is unknown. When teachers show children how to solve a problem and then assign additional problems that are similar, the children are not problem solving but practising. Both are necessary in mathematics, but one should not be confused with the other. If the path for getting to the end situation has already been determined, it is no longer problem solving. Children must also understand this difference.

## Creating Questions for Inquiry in Mathematics

Teachers and children can begin their inquiry at one or more curriculum entry points; however, the process may evolve into transdisciplinary

integrated learning opportunities, as reflective of the holistic nature of our lives and interdependent global environment. It is essential to develop questions that are evoked by children's interests and have potential for rich and deep learning. Compelling questions are used to initiate and guide the inquiry and give children direction for discovering deep understandings about a topic or issue under study.

The process of constructing inquiry questions can help children to grasp the important disciplinary or transdisciplinary ideas that are situated at the core of a particular curricular focus or context. These broad questions will lead to more specific questions that can provide a framework, purpose, and direction for the learning activities in a lesson, or series of lessons, and help children connect what they are learning to their experiences and life beyond school.

Effective questions in mathematics are the key to initiating and guiding children's investigations and critical thinking, problem solving, and reflection on their own learning. Questions such as:

- "When would you want to add two numbers less than 10?"
- "How do you know you have an answer?"
- "Will this work with every number? Every similar situation?"
- "How does your representation compare to that of your partner?"

are examples of questions that will move children's inquiry towards deeper understanding. Effective questioning is essential for teaching and student learning and should be an integral part of planning in mathematics. Questioning should also be used to encourage children to reflect on the inquiry process and the documentation and assessment of their own learning.

Questions should invite children to explore mathematical concepts within a variety of contexts and for a variety of purposes. When questioning children, teachers should choose questions that:

- help children make sense of the mathematics.
- are open-ended, whether in answer or approach. There may be multiple answers or multiple approaches.
- empower children to unravel their misconceptions.
- not only require the application of facts and procedures but encourage children to make connections and generalizations.
- are accessible to all children in their language and offer an entry point for all children.
- lead children to wonder more about a topic and to perhaps construct new questions themselves as they investigate this newly found interest.

(Schuster & Canavan Anderson, 2005, p. 3)

## References

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