# Research Brief

## High Level Thinking and Questioning Strategies

**Questions:** What does the research say about higher level thinking activities for students?
What about questioning strategies for teachers?
How does a principal work with teachers to strengthen their instructional skills in these areas?

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**In a Nutshell**

Higher-order thinking is an instructional strategy supported by research. Often referred to as critical thinking skills, it is more than simple recall of facts or information. It is a function of the interaction between cognitive strategies, meta-cognition, and nonstrategic knowledge when solving problems.

Higher-order thinking is based on the concepts in the cognitive domain of Bloom's Taxonomy. It suggests that some types of learning require more cognitive processing than others. Bloom's Taxonomy suggests that skills involving analysis, evaluation and synthesis are of a higher order, requiring different instructional practices. It also suggests that higher-order thinking involves "the learning of complex judgmental skills such as critical thinking and problem solving." Higher-order thinking is thought to be more useful because such skills (analysis, synthesis) are considered more likely to be useable in situations other than those in which the skill was initially learned.

Questioning is one of the "essential nine" instructional practices identified by Marzano, Pickering & Pollock, 2001). It is closely linked to higher-level thinking and Bloom's Taxonomy. While teachers' use of questions is predominantly low-level, professional development can help teachers develop the skill to design and use questions that engage students in higher-level instructional processes.

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**Summary of Findings**:
Authentic instruction is a model for high-quality instruction developed by Fred Newmann (1993). He identified five major components of authentic instruction and include:
- *Higher-order thinking* that requires students to use and "manipulate information and ideas in ways that transforms their meaning and implications, such as when students combine facts and ideas in order to synthesize, generalize, explain, hypothesize, or arrive at some conclusion or interpretation." Higher-order thinking expects students to "solve problems and develop meaning for themselves." Because of these expectations it involves an "element of uncertainty and unpredictability."
- *Depth of knowledge* where students "deal with the significant concepts or central ideas of a discipline. Students use knowledge to understand arguments, solve problems, or construct explanations."
- *Connection to the world beyond the classroom* is the third attribute of authentic instruction. It suggests that instruction "connect the classroom to some "real world problem" or personal experience that the student can relate to. "
- *Substantive conversation* is the fourth attribute and involves considerable discussion and interaction about the key ideas of a topic that builds on ideas shared by others in the conversation. It suggests that instruction provide time to share ideas, generate alternatives, and engage students in examination of ideas focused on developing shared understanding.

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- *Social support for student achievement* is the fifth attribute. It is characterized by "high expectations, respect, and inclusion of all students in the learning process." Social support is more than just acknowledgement or praise for participation. "It occurs when teachers convey high expectations for all students and encourage all students to participate in the learning experience."
  (From:   www.ncrel.org/sdrs/areas/issues/educatrs/leadrshp/le4auth.htm)

Researchers at the Mid-Continent Research for Education and Learning (McREL) identified nine essential instructional strategies. They are among the strategies most likely to improve student learning across content areas. *Classroom Instruction That Works* by Marzano, Pickering and Pollock details the nine strategies (Available from ASCD – www.ascd.org). They include:

1. Identifying similarities and differences
2. Summarizing and note taking
3. Reinforcing effort and providing recognition
4. Homework and practice
5. Nonlinguistic representations
6. Cooperative learning
7. Setting objectives and providing feedback
8. Generating and testing hypotheses
9. Cues, questions, and advance organizers

(www.middleweb.com/MWLresources/marzchat1.html)

A brief video where Dr. Marzano describes the nine strategies is available at:
http://www.youtube.com/watch?v=qzhTKl79xXo.

**Questioning**
While questioning is identified as one of the most effective instructional strategies, research on questioning indicates that the use of questions by teachers is predominantly low level. Researchers suggest that professional development on the effective use of questioning strategies and the development of high-level questions is helpful to teachers.

Teachers ask hundreds of questions every day and it is important that they use questioning techniques that challenge the thinking of all of their students.
Here are five teaching tips for high-level questioning from Adam Waxler
(www.eslteachersboard.com/cgi-bin/articles/index.pl?read=3789 .

1. Require ALL learners to answer the question. This is when using the "all-write" strategy is very helpful. Instead of simply asking a question and having one or two students raise their hand to answer, the teacher should have ALL students write down an answer to the question. This way the teacher has gotten all of her students involved in the question and answer process. Or, instead of having all students write their answer, the teacher could simply ask the question and have ALL students share their response with a partner.
2. Require students to defend, or back-up, their answers.
3. Use Bloom's Taxonomy to create high-level questions. For example, instead of asking, "Which U.S. President authorized the use of the atomic bomb at the end of World War II?" a teacher could ask, "Was President Truman justified in using the atomic bomb to end World War II and why do you think that?"
4. Differentiate questions as appropriate.

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5. Promote examination of new and different perspectives. For example, instead of asking, "What happened at the Boston Tea Party?" a teacher could ask, 'If you were a British soldier, how would you have reacted when you heard the news about the Boston Tea Party?"

*Bloom's Taxonomy and Questioning*
Benjamin Bloom developed a taxonomy of learning objectives. The taxonomy is divided into three parts---affective, psychomotor and cognitive. The cognitive domain includes six levels from knowledge and comprehension at the lowest level to synthesis and evaluation at the highest level (http://www.officeport.com/edu/blooms.htm). Questions that engage students in analysis, synthesis and evaluation are considered higher-level.

*Resources for Improving Questioning Strategies* – Several sites provide examples of questions that reflect the different levels of Bloom's Taxonomy. They include:

http://www.officeport.com/edu/bloomq.htm - This site suggests sample questions for the higher levels of the taxonomy.

http://www.teachers.ash.org.au/researchskills/dalton.htm - This site provides examples of useful verbs, question stems and instructional activities that incorporate the different levels of Bloom's Taxonomy.

http://classtools.net/twitter/tweet.php?message=A%2520Questioning%2520Toolkit&url=http://www.fno.org/nov97/toolkit.html. - The *Educational Technology Journal* provides a Questioning Toolkit that teachers can use to strengthen their use of questions.

http://www.readinglady.com/mosaic/tools/Strategy%20Rubrics%20by%20Carrie%20and%20Kerry.doc. - This site provides a rubric that can be used to assess the quality of questions.

**Higher-Order Thinking Skills**
Higher-order thinking is another instructional strategy supported by research. Often referred to as critical thinking skills, it is more than simple recall of facts or information retrieval but rather a function of the interaction between cognitive strategies, meta-cognition, and nonstrategic knowledge during problem solving. Higher-order thinking skills are "goal directed, multi-step, strategic processes such as designing, decision-making and problem solving" that require analysis, evaluating, connecting, imagining, elaborating and synthesizing (Iowa Department of Education 1989), some of the higher levels of Bloom's taxonomy.

Higher-order thinking is also based on the concepts in the cognitive domain of Bloom's Taxonomy and suggests that some types of learning require more cognitive processing than others. Bloom's Taxonomy suggests that skills involving analysis, synthesis and evaluation are of a higher order, requiring different instructional practices. It also suggests that higher-order thinking involves "the learning of complex judgmental skills such as critical thinking and problem solving." Higher-order thinking is thought to be more useful because such skills (analysis, synthesis) are considered more likely to be useable in situations other than those in which the skill was learned.

*Resources for High Level Thinking Skills*

http://www.educationpartnerships.org/

Taxonomy of Socratic Questioning - http://ed.fnal.gov/trc_new/tutorial/taxonomy.html

**The Principal's Role in Improving Instruction**
The principal's role as an instructional leader is closely linked to improved student learning. While the relationship is less direct than that of a teacher, or a quality curriculum, it is nevertheless important. Leithwood (1994, p.3) describes instructional leadership as a series of behaviors designed to affect classroom instruction. Principals are responsible for providing teachers with access to new educational strategies, technologies and tools that positively impact instruction and "principals must also assist teachers in critiquing these tools to determine their applicability to the classroom (Whitaker, 1997)."

Principals and teachers working together in "communities of learning" have a strong effect on student achievement. Principals who understand and use the principles of adult learning, and who create cultures of collaboration, inquiry, lifelong learning, and reflection positively impact their schools (Blasé & Blasé, 1999). Principals who value professional development and establish trust, create structures that promote teacher learning, and either connect teachers to external expertise or internal support are more likely to impact student learning.

In *Rigorous Schools and Classrooms: Leading the Way* (2010), Ron Williamson and Barbara Blackburn suggest a three-part definition for rigor---creating an environment in which each student is expected to learn at high levels, each student is supported so he or she can learn at high levels, and each student demonstrates learning at high levels. They identify seven specific strategies that principals can use to improve the quality of instruction---creating a positive and supportive school culture, developing shared vision, providing professional development, engaging in advocacy, establishing accountability, and using school organization and structure to improve learning. Each strategy is discussed and accompanied by a set of tools principals can use with their teachers to improve the instructional program in their school. Many of the tools and resources are available at www.ronwilliamson.com and www.barbarablackburnonline.com.

**Final Thoughts**
In his work to identify the "types of instruction that engage students" Newmann established a link between specific learning activities and academic engagement. Higher order thinking, depth of knowledge, connectedness to the world beyond the classroom and substantive conversation (questioning) were the key (Newmann & Wehlege. 1992).

The Center For The Study of Teaching and Policy (http://depts.washington.edu/ctpmail/), supported by the Wallace Foundation, provides an extensive library of resources on leadership and improved instructional practice.

**Resources**:

Blaze, J., & Blasé, Jo. ( 1999). Principals' Instructional Leadership and Teacher Development: Teachers' Perspectives. Educational administration Quarterly. 35(3)349. Online version can be found at Http://eaq.sagepub.com/cgi/content/abstract/35/3/359  This article is divided into sections and discusses prescriptive models of instructional leadership.

Enhanced Learning, 9(1), 55-82   This study indicates that a well designed interactive micro-learning experience leads to learner cognitive engagement and greater degrees of concentration for longer periods of time. It also suggests that with a well-developed program learners migrate towards greater levels of higher order thinking.

Guszak, F. (1968). Questioning strategies of elementary teachers in relations to comprehension. (ED 023 542). This paper analyzed teachers' questioning strategies to determine how they contributed to students' ability to comprehend materials.

Hernandez, S. (2002). Team Learning in a Marketing Principles Course: Cooperative Structures That Facilitate Active Learning and Higher Level Thinking. *Journal of Marketing Education, 24*(1), 73-85.  This article designed for marketing education is relevant for all teaching and learning.  It indicates that questioning can be developed that access student learning along the lines of Bloom's (1956) taxonomy in terms of lower and higher level thinking.

Lewis, A. and Smith, D. (1993). Defining Higher Order Thinking . *Theory into Practice,32*(3), 131-137. The definition of higher order thinking in this article has implications for classroom teachers.  There are five teaching strategies that support the learners' success in developing higher order thinking skills when used appropriately by the teacher.

Lim, C. P. & Tay, L. Y.(2003). Information and Communication Technologies (ICT): Students' Engagement in Higher Order Thinking. *Journal of Educational Multimedia and Hypermedia,* 12(4), 425-451. This case study is rich with support for teaching strategies that first defines higher order thinking and then facilitates a discussion of different types of ICT tools.

Newmann, F. M. & Wehlege, G. G. (1992). Authentic Instruction – A paper prepared for the Center on Organization and Restructuring of Schools at the University of Wisconsin and describes in detail the five attributes of authentic instruction, including a rubric for each item. (http://www.learner.org/workshops/socialstudies/pdf/session6/6.AuthenticInstruction.pdf)

Newmann, F.M. & Wehlege, G. G. (1993). Five Standards of Authentic Instruction.  Association For Supervision and Curriculum Development, 50(7) p. 8 – 12.  This research discusses authentic instruction through the use of a framework developed to assist teachers and researchers in answering complex questions of instruction. (http://pdonline.ascd.org/pd_online/diffinstr/el199304_newmann.html)

Piecki, M. et.al. (2001) *How Leaders Invest Resources for Learning Improvement.* The Wallace Foundation's Knowledge Center.  www.wallacefoundation.org. This study focused on what it means to invest staffing resources to improve learning

Roth, W.M. (1996). Teacher Questioning in an Open-Inquiry Learning Environment: Interactions of Context, Content, and Student Responses.
*Journal of Research in Science Teaching, 33*(7), 709-736. This study details how teachers learn about proper questioning due to the participation in a collaborative practice.

Sellappah, S., Hussey, T.,. Blackmore, A.M and McMurray, A. (1998). The use of questioning strategies by clinical teachers. *Journal of Advanced Nursing, 28*(1), 142–148.


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Based on the result of this study, it is recommended that teachers be taught how to ask questions, particularly those of higher order.

Stoney, S. & Oliver, R. (1999). Can Higher Order Thinking and Cognitive Engagement Be Enhanced with Multimedia? Interactive Multimedia Electronic Journal of Computer

Wilder, A. & Williams, J. (2001). Students with severe learning disabilities can learn higher order comprehension skills. *Journal of Educational Psychology, 93*(2), 268-278  The main purpose of this study was to address the question of whether students with severe learning disabilities could, with appropriate instruction, demonstrate transfer on a high order comprehension skill.

Zohar, A. (1999). Teachers' metacognitive knowledge and the instruction of higher order thinking. *Teaching and Teacher Education,15*, 413-429  This article discusses the call for transforming schools from teaching "basic skills" towards schools for thought.

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