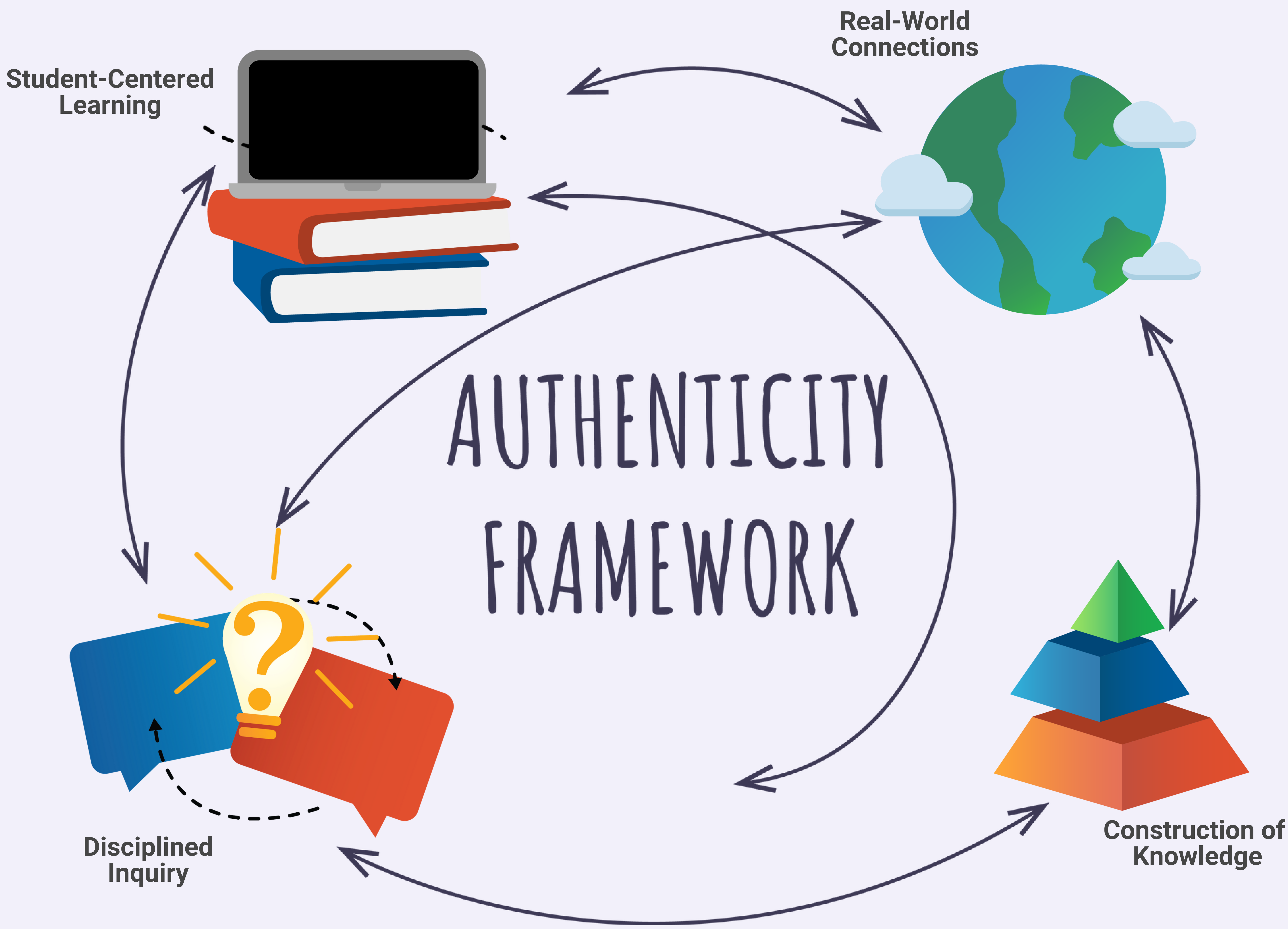
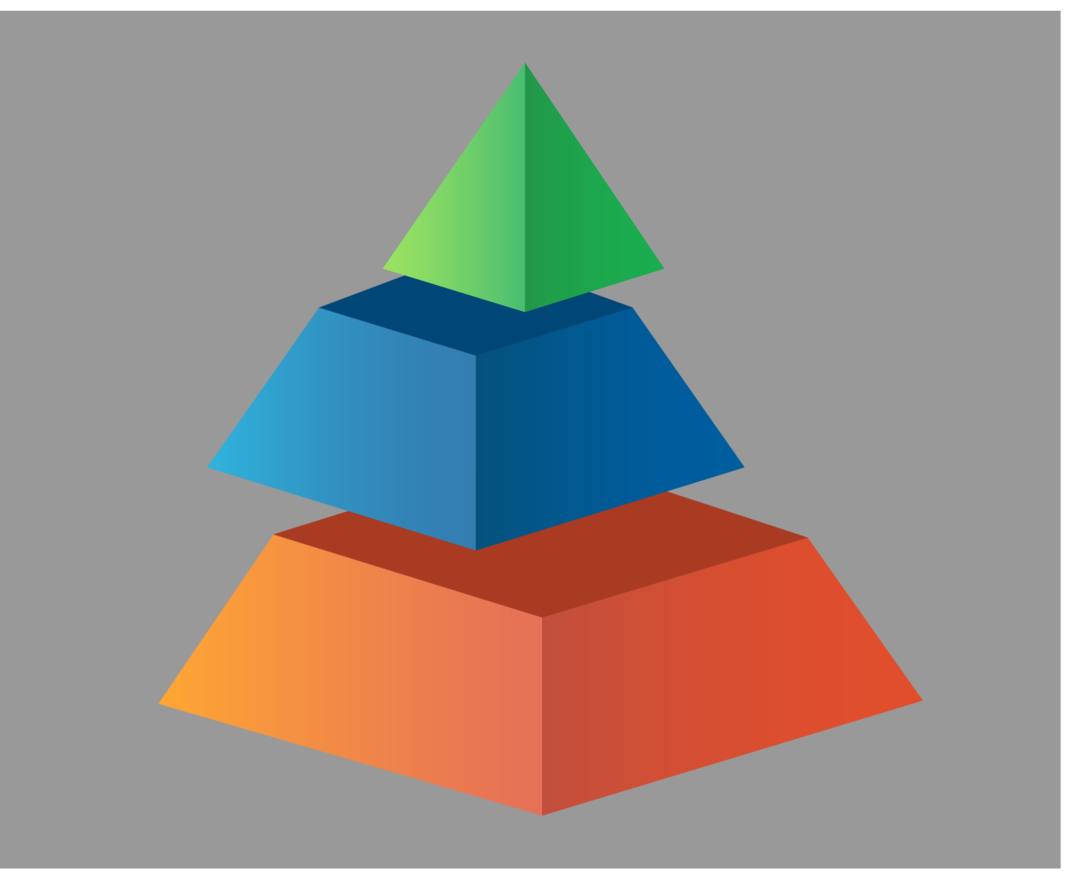


INTRO

Authenticity is a conceptual framework for meaningful student-centered learning. Individuals build on what they already know to create deep knowledge (Bransford, Brown, & Cocking, 2000). The characteristics of authentic intellectual work include "construction of knowledge, through the use of disciplined inquiry, to produce discourse, products, or performances that have value beyond school" (Newmann, Bryk, & Nagaoka, 2001, p. 14). A body of research spanning more than two decades points to the efficacy of authentic learning environments. Newmann and subsequent researchers found that when fidelity to authentic pedagogy is at a high level in the learning environment, student achievement is higher as well, regardless of ethnicity, socio-economic status, or identified disabilities (King, Schroeder, & Chawszczweski, 2001; Kukrai & Spector, 2012; Newmann et al., 2001; Newmann, King, & Carmichael, 2007; Newmann, Marks, & Gamoran, 1996; Saye, 2013; Wirkala & Kuhn, 2011).

CONSTRUCTION OF KNOWLEDGE | DISCIPLINED INQUIRY | REAL WORLD CONNECTIONS | STUDENT-CENTERED LEARNING

CONSTRUCTION OF KNOWLEDGE



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"The only source of knowledge is experience."
-- Albert Einstein

You've heard the expression, "You have to walk before you can run." It's not meant to be taken literally, but when we do so, it illustrates the importance of prior learning when creating new knowledge. Similarly, knowledge is formed in the classroom by connecting past experiences to new ideas.

A cornerstone of authentic learning—learning that is significant and meaningful—is that students construct meaning and produce knowledge (Newmann & Wehlage, 1994). The term "construction of knowledge" refers to this dynamic, active process in which students strive to make sense of new information (Stoll, Fink, & Earle, 2003). But what tools do students need to do so? They include making prior knowledge connections, interacting with open-ended questions, and activating higher-order thinking skills.

Prior Knowledge Connections

To process new knowledge, students first must elicit prior, related knowledge. By comparing the old knowledge to the new, students construct meaning by manipulating information and ideas in various ways to arrive at new conclusions. One of the most important things a teacher can do to encourage construction of knowledge is to introduce new content within a familiar frame of reference (King, Goodson, & Rohani, 1998). These researchers noted that analogies are a great way to facilitate prior knowledge connections because they provide a familiar context for new knowledge. For example, you might tell students that "the human eye is like a camera." From that starting point, students can draw upon their current knowledge about cameras to form new ideas about how the eye works—that it has a lens, that it can focus, and that it records images to "memory" (the brain, in this case rather than a digital storage space or a "cloud"). This processing of new information helps facilitate the "transfer" of old experiences to new understandings. In How People Learn, Bransford, Brown, and Cocking (2000) noted that "all learning involves transfer from previous experiences."

Construction of knowledge naturally lends itself to experimentation and "learning by doing" as opposed to "teaching by telling." Learning involves the retrieval of learners' memories, and this is guided by cues in the learners' environment. These cues might include prompts, questions, or problems that are posed in the classroom, or the learner's own ideas (NASEM, 2018). This "retrieval cueing" works for all types of learning—from simple to complex—but may require time for the learner to explore ideas and form connections between new and prior knowledge.

Open-Ended Questions

A key retrieval cueing method that contributes to the transfer of knowledge is the use of open-ended questions. The use of "what if" scenarios can improve flexibility by allowing students to stretch their learning into new scenarios (Bransford, Brown, & Cocking, 2000). For students who are learning that their eyes are like cameras, you might ask, "What if you try to take a picture in the dark?" Learners might then explore the connections between light and visibility and how the two are related. Another strategy for open-ended dialogue involves self-explanation. This technique challenges learners to actively make sense of their learning by explaining new information themselves, as opposed to having the teacher explain it to them. During self-explanation, learners relate their new knowledge to prior knowledge, sparking a transfer and documentation of information.

Strategies to stimulate self-explanation include asking questions about paradoxes and dilemmas, having students generate their own questions, starting with lower-order questions and leading up to more complex problems, and providing wait time after asking questions (King, Goodson, & Rohani, 1998). Lastly, the questions that are asked of students—and the ones they ask themselves during self-explanation—must elicit answers that have not already been shown. This leads to higher-order thinking.

Higher-Order Thinking

Critical, logical, reflective, metacognitive, and creative reasoning—each of which is included in higher-order thinking—are skills activated when students encounter "unfamiliar problems, uncertainties, questions, or dilemmas" (King, Goodson, & Rohani, 1998). Demonstrating these skills successfully—through explanations, decision, performances, and products—promotes continued intellectual growth.

Students who are studying the human eye might be challenged to explain how corrective lenses or contacts can improve vision. They might use concave or convex lenses to discover and explain how these different shapes affect light rays and correct either nearsightedness or farsightedness. In doing so, they would need to retrieve personal knowledge regarding how cameras and eyes work, recall what they have learned about light and lenses, and adapt and transform this information to apply it to a new situation—how glasses can correct vision problems. Higher-order thinking can be guided with strategies, by students "filling in information that is missing in a logical sequence, extending an incomplete argument or evidence, and rearranging the information to effect a new interpretation by moving through a series of interconnected steps" (King, Goodson & Rohani, 1998, p. 35–36). Developing higher-order thinking skills depends on mastery of lower-order content, linking prior knowledge to current information through scaffolding, and finally through challenging students with situations that contribute to the use of reasoning.

Knowledge that is constructed by students is lasting, can be built upon, and leads to greater understanding and better application. Remember, however, that students must walk before they can run, and to facilitate this, educators must create an authentic learning environment that allows students to access prior knowledge, interact with open-ended questions, and develop higher-order thinking skills. This is what construction of knowledge depends on. When a student is allowed to construct knowledge in an authentic learning environment, their vision of learning is brought into focus.

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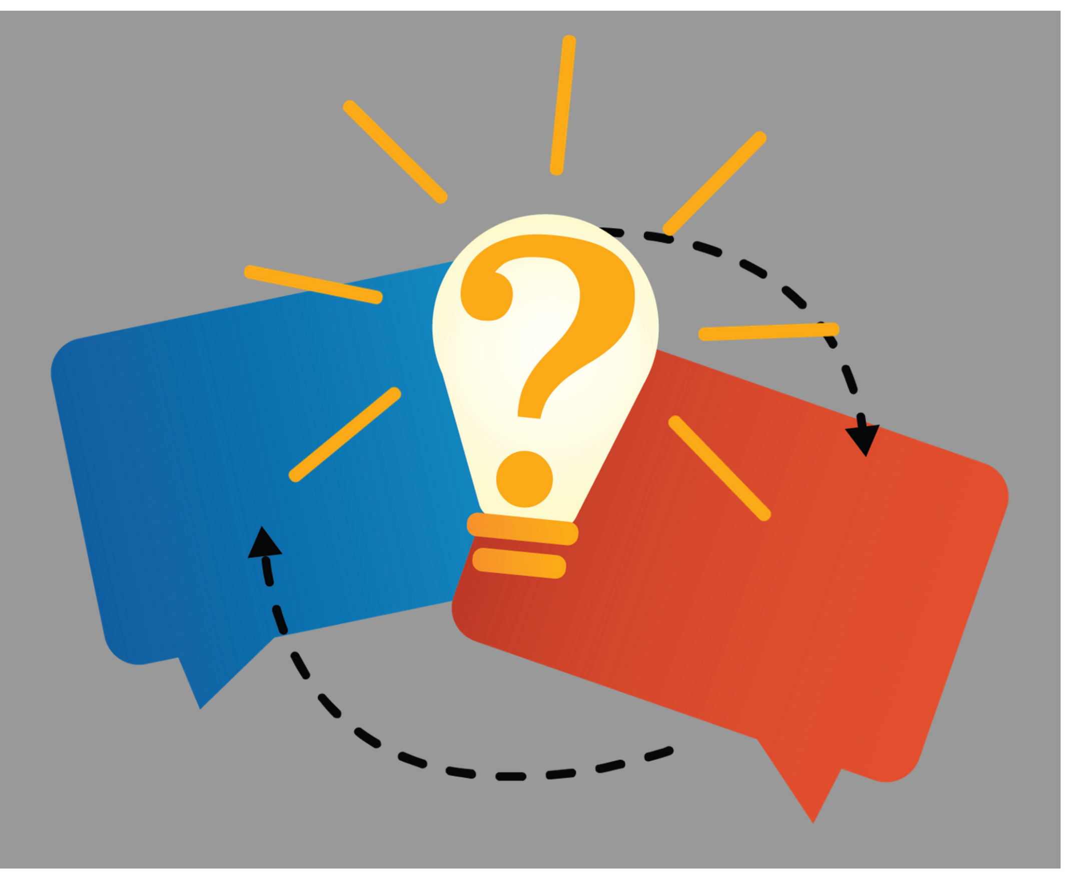
DISCIPLINED INQUIRY



Tell me and I forget. Show me and I remember.
Involve me and I understand.
-- Chinese proverb

Have you ever thought about how you go about learning something new? Let's say you need to assemble a child's bike. You could read the instruction manual. You could watch a how-to YouTube video. Or you could dive in headfirst and try figuring it out on your own! If you choose the latter method, you'll likely make some mistakes along the way (and you may need to consult that manual for help) but you might also discover that, by the time the bike is assembled, you have a better understanding of how bikes work!

Let's take a deeper dive into disciplined inquiry and some of the ways that teachers, according to research, can encourage this type of learning. Disciplined inquiry is sometimes associated with what you may call "discovery learning." Disciplined Inquiry is organized around deepening knowledge through meaningful questions and supporting substantive conversations.

Deepening Knowledge Through Meaningful Questions

Deep knowledge concerns the core ideas of a topic or discipline and occurs when students make clear distinctions, develop arguments, formulate meaningful questions, solve problems, construct explanations, and otherwise work with complex understandings. Deep knowledge is accomplished by investigating connections between topics, focusing on depth instead of breadth, as students recognize relationships between ideas. Deep knowledge is demonstrated when students can articulate and demonstrate a complex understanding of the content to others (McTighe & Wiggins, 2013; Newmann & Wehlage, 1993).

While students are actively engaged in problem-solving, their inquiry must maintain an emphasis on the core ideas—that is, those that revolve around depth, not breadth, focusing on major ideas but not every single small detail. Kukral and Spector (2012) stressed the need to "zero in on the academic content, students' relationship to that content, and teachers' knowledge and skill." They warn against focusing on policy changes and test prep, noting that these won't lead to students "learning at high levels in order to succeed in our exponentially changing world."

Similarly, Bowen (2017), commenting on Wiggins and McTighe's (2006) Understanding by Design, noted in favor of "backward design" that student outputs are more important than activities and instruction. Bowen writes, "it can be stated that teachers often focus more on teaching rather than learning. This perspective can lead to the misconception that learning is the activity when, in fact, learning is derived from a careful consideration of the meaning of the activity." An emphasis on the central idea keeps the inquiry dedicated to achieving that goal.

One might describe complex understanding as greater than the sum of its parts. Or, as Newmann, Marks, and Gamoran put it, "In-depth understanding requires more than knowing lots of details about a topic. Understanding occurs as one looks for, tests, and creates relationships among pieces of knowledge that can illuminate a given problem or issue" (1996). Complex understanding contributes to deep learning and is developed through disciplined inquiry "as one looks for, imagines, proposes, and tests relationships among key facts, events, concepts, rules, and claims in order to clarify a specific problem or issue" (Newman, Bryk, & Nagaoka, 2001).

Authentic learning—exploring meaningful concepts, their relationships, and real-world context—is inherent to disciplined inquiry and complex understanding. Rule (2006) noted that rich problems adhere to principles such as "personal meaningfulness to students; construction, refinement, or extension of a model; self-evaluation; documentation of mathematical thinking; useful prototype for other structurally similar problems; and generalization to a broader range of situations." Not surprisingly, these traits are similar to the traits of good essential questions.

Meaningful (or essential) questions frame a unit of study as a problem to be solved. A good essential question is key to the design of "inquiry-based learning that requires student contributions, creativity, and applications" (Wilhelm, 2012). As the term "essential" implies, the question should be vital and foundational to the learning. But it should also be open-ended, provoke thought, require higher-order thinking, and be relevant to students. It should also connect students' experiences (that is, their prior knowledge) to real-world problems (Wilhelm, 2012; McTighe & Wiggins, 2013).

McTighe and Wiggins (2013) noted that essential questions "are not answerable with finality in a single lesson or a brief sentence—and that's the point," and that these questions "aim to stimulate thought, to provoke inquiry, and to spark more questions, including thoughtful student questions, not just pat answers." These researchers went on to define the characteristics of a good essential question that would engage learners in "uncovering the depth and richness of a topic that might otherwise be obscured by simply covering it."

When a good essential question succeeds by creating more questions, an "inquiry evolution" (Lillydahl, 2015) takes place. Lillydahl contends that a new essential question can be used at the end of a unit as well, as a means of assessment and to exhibit the progression of analysis the disciplined inquiry creates.

Substantive Conversations

A typical school day may only provide a few minutes at most for students to talk about what they are learning (Gibbs, 2006). On the other hand, student conversations, supported by cooperative learning structures, have a reputation for developing skills in learners that are relevant to success in today's society. Social skills, problem-solving skills, cultural competency, and increased self-efficacy are all supported when students work together in the classroom (Chui, 2008; Johnson & Johnson, 2009; Nemeth-Wachtler, 1983; Sharan, 2010; Huber & Snider, 2006).

Researchers have noticed that student understanding of complex issues changes as the conversation is happening. When students discuss their learning, their learning is made visible to themselves which aids the development of metacognitive skills. Students are able to come to know what it is that they know better as they talk through it (Chiu, 2008; Resnick, Michaels, & Connor, 2010). This visible learning is also valuable for the instructor who can see what students' prior understandings are, their misconceptions, and how their knowledge is changing over the course of a lesson.

"Sharing out" isn't just about participating; it actually stimulates learning. Windschitl, Thompson, and Braaten (2018) noted that joining in on the conversation requires students to activate prior knowledge, process what others have said, think through possible and appropriate responses given the classroom dialogue, then make adjustments, and say them out loud—all in real-time! Contributing to the conversation requires reasoning, giving structure to concepts, and doing so allows the speaker to assess and correct logic gaps, resulting in deeper learning.

"Taking a turn within a conversation requires that you activate prior knowledge about what's being said by others, organize possible responses that will fit the flow of the dialogue as well as the nature of your audience, and then verbalize your own ideas while monitoring and adjusting in real time what you are saying. This stimulates learning because translating ideas into words is no simply the 'reporting out' of what is fully formed in one's head. Under the right circumstances it involves reasoning processes that give structure to loosely formed concepts and makes gaps in logic more evident for those doing the talking." (p. 39-40)

There are a number of academic benefits for students and teachers which can be accomplished purely by giving time and space in the classroom for students to have conversations. When student conversation is an integrated part of the learning, students get practice working with one another, they get practice being accountable to others, listening, sharing their ideas in ways that others can understand, and working together to make decisions (Gillies, 2016; Resnick, Michaels, & Connor, 2010; Gibbs, 2006). The learning that results from student conversations increases student motivation, self-esteem, and problem-solving outcomes. For teachers, giving students a space to speak gives insight into how students are organizing their thoughts and can serve as formative assessments of what students are learning over the course of a lesson.

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