

Thinking and Academic Success Skills

Recent educational initiatives such as development of the Common Core State Standards have emphasized the importance of teaching and assessing several skills essential for lifelong learning, such as critical thinking, creativity, collaboration, motivation, metacognition, and intellectual risk taking. This paper summarizes the research literature in order to answer several questions about these skills:

1. What are they?
2. How are they related to one another?
3. Why are they important?
4. How do they develop?
5. How can you teach them?
6. How can you assess them?

Pearson Forward specifically targets the development of several types of Thinking and Academic Success Skills. Thinking skills include critical thinking, which involves Analysis, Synthesis, and Evaluation, and creative thinking, which entails Elaboration, Flexibility, Fluency, and Originality. Academic Success Skills include Collaboration; Effort, Motivation, and Persistence; Metacognition; and Intellectual Risk Taking.

What are they?

Thinking Skills

Critical thinking. Critical thinking is “reflective and reasonable thinking that is focused on deciding what to believe or do.”¹ Critical thinking involves both cognitive skills and noncognitive or affective components. Cognitive skills include analyzing claims, arguments, and evidence;² making inferences using inductive or deductive reasoning;³ judging or evaluating;⁴ and making decisions or solving problems.⁵ Affective components, which can be seen as attitudes or habits of mind, include attributes such as open- and fair-mindedness,⁶ inquisitiveness,⁷ flexibility,⁸ a propensity to seek reason,⁹ a desire to be well-informed,¹⁰ and a respect for and willingness to entertain diverse viewpoints.¹¹ Although possessing content-specific background knowledge and skills is a necessary condition for enabling critical thought within a given subject,¹² critical thinking encompasses both general and domain-specific aspects.¹³ In other words, there are critical thinking skills that are common across multiple subjects (e.g., formal rules of logic),

and there are critical thinking skills that are unique to specific subject areas (e.g., the use of proofs in mathematics or the scientific method in science).

Creative thinking. Creativity involves the generation of a novel product, idea, or performance that has some sort of use or value.¹⁴ Creative thinking skills are a specific subset of creativity skills that include both creative thinking processes and the expression of creative ideas. The ability to generate and evaluate novel ideas is important to the creative thinking process and involves cognitive skills such as fluency, flexibility, originality, and elaboration.

Although some scholars reserve the designation of creativity for novel products that have a profound impact on society, many scholars support the idea of everyday creativity, obtainable by most people on some level.¹⁵ Everyday creativity can be as basic as constructing personal new meaning, similar to Piaget's concept of assimilation.¹⁶ Creative output at this level may be novel only for the individual doing the creating.¹⁷ Creative achievement depends on a combination of cognitive abilities and dispositions. Cognitive abilities include divergent thinking, problem identification, and problem-solving skills. Dispositions include motivation, intellectual risk taking, self-efficacy, tolerance of ambiguity, and openness to new ideas.¹⁸ Actual creative outputs such as sculpting a statue or designing a scientific experiment are more domain specific, due to the need to employ specific background knowledge and skills to be successful at a particular creative endeavor. On the other hand, the specific cognitive abilities and dispositions that influence creativity show varying degrees of domain specificity. For example, the ability to think divergently is relatively transferable across different content domains, whereas motivation and self-efficacy may be more domain specific.¹⁹

Academic Success Skills

Collaboration. Collaboration occurs when two or more people work together to achieve a common goal.²⁰ Interactions that are truly collaborative involve the construction or convergence of shared meaning.²¹ In other words, collaboration is “coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem.”²² Such interactions require coordination of effort and interdependence of individual contributions, with participants working together on the same task.²³ Collaboration requires high levels of interactivity and negotiability. Interactivity suggests that participants' interactions influence their thinking. Negotiability implies that no single participant can unilaterally impose a solution.²⁴ Subskills necessary for successful collaboration include effective communication skills, appropriate help-seeking behavior, willingness to provide help to others, coordination, conflict resolution, decision making, problem solving, and negotiation.

Effort, Motivation, and Persistence. Effort, Motivation, and Persistence (hereafter referred to simply as motivation) refer to all the reasons that underlie willing and volitional behavior.²⁵ Motivation is a complex concept that is influenced by a person's perceptions, values, interests, and goals.²⁶ Researchers often distinguish intrinsic from extrinsic motivation. When people are intrinsically motivated, they pursue activities for personal enjoyment, interest, or pleasure. On

the other hand, when people are extrinsically motivated, they pursue activities because of a desire to earn or avoid external rewards or sanctions.²⁷ Educators have traditionally considered intrinsic motivation to be more desirable and to result in better learning outcomes than extrinsic motivation. Some research has demonstrated that intrinsic motivation leads to greater persistence at challenging tasks and better learning over time than extrinsic motivation.²⁸

Metacognition. Metacognition is thinking about thinking in a purposeful way to achieve particular cognitive goals.²⁹ Metacognition has two components: knowledge about cognition and regulation of cognition. Metacognitive knowledge includes knowledge about oneself as a learner and the factors that might impact performance, knowledge about strategies, and knowledge about when and why to use particular strategies. Metacognitive regulation is the monitoring of one's thought and includes planning, awareness of comprehension and task performance, and evaluation of strategy success.³⁰ Metacognition is domain general and is distinct from general intellectual ability, which tends to be more domain specific. Metacognition may even help to compensate for deficits in intelligence or prior knowledge on a subject during problem solving.³¹

Intellectual Risk Taking. Intellectual risk taking can be defined as “engaging in adaptive learning behaviors (sharing tentative ideas, asking questions, attempting to do and learn new things) that place the learner at risk of making mistakes or appearing less competent than others.”³² Although intellectual risk taking behaviors can lead to advances in knowledge, the fear of having one's ideas dismissed or even ridiculed may prevent a person from actively engaging in intellectual risk taking. Intellectual risk taking may be somewhat domain specific.³³ This is likely a reflection of the dependence of intellectual risk taking on motivation, interest, and self-efficacy, which each display a large degree of domain specificity.³⁴ For example, people may be more likely to share tentative ideas and ask questions about subjects in which they feel relatively competent or in which they have a particular interest.³⁵ Intellectual risk taking also depends on a person's subjective perception of risk. In other words, what one person perceives as a risk may be very different from what another person perceives as a risk.³⁶

How are they related to one another?

Research on these skills suggests they are interrelated in complex ways. For example, critical thinking and creativity are often expressed together. Flexibility, a subskill of creativity, supports critical thinking to the extent that being open-minded and willing to see from diverse perspectives is a key disposition when making decisions or solving problems. Likewise, the critical thinking skills of analysis, synthesis, and evaluation are often identified as key components of the creative process.³⁷ Creativity itself is related to the propensity to take intellectual risks, because creativity often involves the production of something new and untested, making it susceptible to societal rejection.³⁸ In turn, intellectual risk taking is highly

dependent on motivation and may serve as a link between certain creativity antecedents, motivation, and creative outputs.³⁹

Motivational goals greatly influence the propensity to take intellectual risks. People who hold competency or mastery goals are more likely to take intellectual risks than those who are performance-driven or have ego-oriented goals. The former view intellectual risks as opportunities to receive feedback on their current skills and strategies, which can then be used to increase their knowledge and improve their skills. The latter frequently avoid taking intellectual risks because the possibility of failure undermines their need to appear competent and minimize errors.⁴⁰ In addition, providing students with optimally challenging tasks that encourage intellectual risk taking (i.e., those that present a moderate probability of success) may increase student motivation to engage in the learning process.⁴¹

Motivation and metacognition are also reciprocally related: motivation supports metacognition and vice-versa. Metacognition actually includes the ability to manage one's mood and motivation levels. Likewise, metacognitive strategies, such as formulating a plan to break down a task into subtasks, can improve students' persistence when they encounter challenges.⁴² Research suggests that children who better regulate their emotions—such as frustration experienced while attempting a challenging task—enjoy more positive social relationships at school, which then increases their level of engagement and motivation to learn.⁴³

Finally, several of these skills are related to collaboration. Research suggests that providing students with opportunities to work together may prompt increases in students' critical thinking, motivation, and metacognition. Collaborative learning approaches are believed to encourage development of critical thinking to the extent that working with others stimulates cognitive conflict, which occurs when a student encounters new information or experiences that conflict with his or her existing frameworks.⁴⁴ Similarly, collaborative approaches promote metacognitive development among students when they are prompted to provide elaborated explanations and make their thinking and reasoning visible. Providing such explanations can help students become more aware of their own thinking.⁴⁵ Peer encouragement may improve task engagement, and the novelty of collaborative learning tasks causes students to pay closer attention.⁴⁶ Working with others is a way of enhancing interest in the task.⁴⁷ Collaboration also provides opportunities for peer modeling, and students may find models of successful student performance to be more motivating than models of teacher performance.⁴⁸

Why are they important?

Although these skills are not new, it was not until very recently that educators and policy makers agreed that they should be explicitly included in academic content standards, directly taught alongside the regular academic curriculum, and routinely assessed for all students. For example, the Partnership for 21st century skills advocates adoption of local, state, and

federal policies that support explicit integration of 21st century skills into instruction for all students.⁴⁹ The two consortia formed in response to *Race to the Top* both highlight college and career readiness as their primary educational target.⁵⁰ Furthermore, the Common Core State Standards anchor K-12 academic standards in expectations that all students will be college-or-career-ready upon high school graduation.⁵¹

Several of these skills are associated with student learning and achievement. For example, research suggests that motivation in children predicts motivation later in life, and the stability of this relationship strengthens with age.⁵² When students are motivated, they are more likely to remain on-task, deploy optimal effort, and persist at difficult tasks despite challenges. In addition, engaging in intellectual risk taking behaviors promotes learning and academic achievement. Sharing tentative ideas helps form student identity, which in turn supports academic achievement.⁵³ Moreover, challenging oneself by engaging in tasks just beyond one's current abilities is a critical component of Vygotsky's zone of proximal development, thus highlighting the importance of intellectual risk taking in cognitive development.⁵⁴

Interventions targeted at improving creative thinking have also been successful at increasing student scores on content-based standardized tests.⁵⁵ Similarly, studies have shown that scores on creativity tests are better predictors of first-year college students' grade point averages when compared to more generalized intelligence tests.⁵⁶ More generally, as technology continues to advance, people will increasingly be required to think in creative and divergent ways in order to address new types of problems.⁵⁷ Creativity itself contributes significantly to today's rapidly changing society. New approaches to fields of study lead to innovations that move the fields forward—either by looking at old ideas in new ways, advancing current thoughts, introducing completely new concepts, or by integrating diverse concepts in new ways.⁵⁸

Metacognition may help to compensate for deficits in intelligence or prior knowledge of a subject during problem solving.⁵⁹ For example, as demonstrated in research studies, students with high metacognitive skill levels tend to outperform students with low metacognitive skills on complex and unfamiliar tasks, even when the two groups are equally matched in ability or aptitude. Some researchers speculate that this is because students with strong metacognitive skills activate problem-solving heuristics (such as creating a graphical representation of a word problem) and “improvise” strategies more efficiently than students without such metacognitive skills.⁶⁰

Collaboration also has powerful effects on student learning. These effects are seen in the form of higher scores on work completed collaboratively, even when students turn in separate products. In addition, evidence suggests that learning that occurs during collaboration persists.⁶¹ In other words, after collaborating with others, a student's performance on subsequent, related tasks completed individually tends to be higher than the performance of similar-ability students who only work alone. Thus, engaging in collaborative learning opportunities with classmates can have a lasting impact on individual student learning.

Collaborating can also increase students' social competency (e.g., conflict resolution skills and use of helping behaviors) and academic self-concept.⁶²

How do they develop?

Research on the development of these skills is incomplete and results are generally inconsistent. A few trends are evident, however. For example, research on the cognitive aspects of critical thinking, collaboration, and metacognition suggests that they tend to develop in parallel with general cognitive development.⁶³ Although early theoretical frameworks tended to view the critical thinking and metacognitive capabilities of young children as rather limited, more recent research suggests that young children are capable of crude forms of these skills.⁶⁴ For example, research suggests that children as young as five are capable of evaluating the credibility of sources of information, monitoring their own task performance, and considering divergent perspectives.⁶⁵ In addition, critical thinking and metacognition tend to increase with both age and appropriate instruction.⁶⁶

Similarly, several types of creativity-related cognitive skills are recognized to increase with age. On the other hand, development of other creativity-related skills, such as divergent thinking and flexibility, may alternate with the development of logical thinking skills. In fact, these skills temporarily stagnate or decline at a time when logical thinking skills usually crystallize.⁶⁷

Motivation and intellectual risk taking appear to take a slightly different developmental path. Research suggests that children initially enter school with high levels of intrinsic motivation, which tend to decline as children progress through school.⁶⁸ Similarly, research has demonstrated that a person's tolerance for failure and perceptions of his or her own intellectual risk taking decline with age, as do intellectual risk taking behaviors unless they are reinforced with appropriate instruction and classroom support.⁶⁹

How can you teach them?

Research suggests that there are components of each of these skills that are teachable.⁷⁰ In addition, several instructional strategies appear to hold promise for encouraging their development. For example, teachers are urged to provide explicit instruction on these skills. In other words, it cannot be assumed that students will develop these skills on their own in the course of learning more traditional subject-matter knowledge and skills. Rather, teachers must reserve instructional resources (i.e., time and effort) for explicit teaching of these skills, and for creativity, critical thinking, and metacognition this explicit instruction should be embedded within the context of domain-specific learning.⁷¹ That is, instruction on these thinking and academic success skills ought to occur alongside instruction in traditional academic content. For example, as teachers are providing instruction in writing opinion pieces, they can also develop students' metacognitive knowledge about particular writing strategies (such as

when and why to use transitional phrases to connect opinions and reasons), and support metacognitive regulation by requiring students to monitor, evaluate, and report on their own progress within the writing process.

Second, because many of these skills (e.g., critical thinking, creativity, motivation, metacognition, and intellectual risk taking) represent a blend of cognitive and affective components, teachers should design instruction that addresses both aspects.⁷² In other words, students' emotions, attitudes, and dispositions can mediate their thinking and behavior during learning. Strategies for providing affective support can include encouraging students' perceptions of self-competence; providing specific, timely, and informational feedback; tailoring learning activities to student interest where possible; and being receptive to student ideas and opinions, even when they don't conform to a teacher's expectations.⁷³ Teachers should also encourage students to become more aware of their emotions and how their emotions impact learning, including developing strategies for regulating emotions and motivation levels during challenging tasks.⁷⁴

Another commonly recommended strategy for encouraging the development of these skills is the use of collaborative learning tasks. Providing students with opportunities to work in groups is said to stimulate cognitive conflict and challenge deeply held assumptions.⁷⁵ When students work together, they must provide elaborated explanations to make themselves understood. Providing such explanations can serve to identify misconceptions and make student reasoning and beliefs visible.⁷⁶ Under ideal conditions, working with others can also promote task interest, increase engagement, and encourage students to consider diverse perspectives.⁷⁷

Teachers should also use student-centered or autonomy-supportive instructional approaches. Such approaches emphasize the student's role in his or her own learning⁷⁸ and provide opportunities for students to exercise autonomy by giving them choices about learning and assessment activities.⁷⁹ Giving students choices might entail letting them make decisions about when they will complete assignments; allowing them to score their own work and chart their progress over time; setting up independent learning centers; or allowing students to select what tasks they will perform, what texts they will read, what subtopics they will pursue, and what response modes they will use.⁸⁰

Educators are also urged to model desired behaviors and attitudes in the classroom. Such modeling might take the form of "thinking aloud" to make thought processes and reasoning visible to students.⁸¹ Peers can also serve as effective models, particularly for students with learning difficulties, because similarly skilled peer models can be more motivating for struggling learners.⁸² Finally, teachers should establish classroom environments that support development of these thinking and academic success skills. Such environments avoid the use of rewards and sanctions,⁸³ establish incentives for student interdependence,⁸⁴ encourage students to set appropriate goals for themselves, teach students to hold adaptive attributions, and use external evaluation only to provide competency-related information.⁸⁵

How can you assess them?

There are multiple challenges in assessing these skills. First, creativity, critical thinking, motivation, intellectual risk taking, and metacognition all entail both cognitive and noncognitive or affective components. Cognitive components of these constructs include knowledge and strategies, whereas affective components include attitudes and dispositions. These two elements are commonly confounded in practice. In other words, the ability to think critically cannot be measured independently of the disposition to do so.⁸⁶ Furthermore, many of the more affective aspects of these skills are not directly observable.⁸⁷

Second, several of these skills are somewhat domain specific, which can mean one of two things: (1) measurement of the skill is confounded in practice with measurement of related content knowledge or (2) a person's skill may appear to vary depending on the subject area in which it is assessed.⁸⁸

Third, traditional assessment paradigms utilizing multiple choice items are not well-suited to measuring these types of skills.⁸⁹ Moreover, existing single measures, including self-report surveys, attitudinal inventories, and behavioral checklists or rating scales completed by parents or teachers, may only capture limited aspects of the skills.⁹⁰

Research identifies several assessment strategies that may help to mitigate these challenges. First, assessment systems should reflect both cognitive and noncognitive components to provide a more complete picture of student skills.⁹¹ To assess metacognition, for example, one might pair a task measuring students' ability to monitor and evaluate task performance with a student self-rating scale designed to capture more affective components, such as the ability to regulate emotion and motivation during task engagement.

Second, assessments should sample from multiple content domains. Researchers argue that several of these constructs (e.g., critical thinking, creativity, motivation, intellectual risk taking) are domain specific, which implies that a student may exhibit the skill in one domain (e.g., science) but fail to do so in another (e.g., writing). Domain specificity stems from the content-specific knowledge required to exercise the skill. Thus, assessment should occur across multiple domains.⁹² Student performance in multiple domains could then be expressed as a profile on a given skill reflecting relative strengths and weaknesses.

Third, assessments should use open-ended and/or ill-structured problems that utilize novel or authentic problem contexts and call for complex student performances.⁹³ Ill-structured problems are those with no clearly defined parameters, no clear solution strategies, and either more than one correct solution, or multiple ways of arriving at an acceptable solution. Such problems need to provide an appropriate level of challenge for examinees. In measuring intellectual risk taking, for example, students are often offered a choice of tasks with widely varying difficulty levels.⁹⁴ For motivation, tasks of moderate difficulty are recommended.⁹⁵ For collaboration, it is important to use tasks that cannot be solved by a single group member working alone.⁹⁶

Finally, assessments should use multiple measures of a skill to triangulate inferences about student ability. For example, students can be called upon to evaluate themselves and their peers.⁹⁷ These ratings could then be combined with more objective performance measures and teacher observations to form a more complete picture of student strengths and weaknesses.

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