

O'Donnell, Ken

From: David Marshall [dmarshall@iebcnow.org]
Sent: Monday, November 21, 2011 9:25 AM
To: O'Donnell, Ken
Subject: Critical Thinking Document
Attachments: Icons Introduction.docx

Dear Ken,

Sorry to have taken so long to send this off to you. It was good to see you a couple weeks ago, and I appreciate your inviting John to join us. I enjoyed meeting him and hope to have more such opportunities.

As promised, I have attached the document that my Cal-PASS group has been working on of late. It introduces Sandra Kaplan's Icons for Depth and Complexity. We will be distributing it to faculty in departments in Coachella Valley and I will be giving it to my colleagues at CSUSB. The goal, as I noted when we met, is to use a pre-existing device to promote critical thinking by breaking down that rather vague concept into different strategies for thinking.

Because the icons derive from curricular strategies used in elementary school GATE programs, they can look rather simplistic. That being said, when stacked and combined, they break sophisticated thinking into discrete parts, thereby making complex intellectual processes apparent to students. That's what we tried to show in the Bloom's table (which will be revised to align with the recent revision of the Bloom's categories) on the last page.

I hope it is of interest.

Have a great Thanksgiving,
David

Building a Bridge: Critical Thinking and Student Success

Data provided from Cal-PASS reveals that students moving among the secondary and post-secondary segments wrestle with making the transition from one segment to another. Teachers at each level, thus, should strive to articulate the learning continuum that bridges the disparate segments of our current educational system. One of the significant divisions that separate our segments from one another seem to be language and pedagogy, specifically a lack of a common vocabulary for the development of critical thinking sufficient to meet the expectations of higher education and the demands of a changing 21st century world. We suffer from a general lack of awareness concerning the different degrees of critical thinking and their relationship to the development of students through the educational system and beyond.

One potential contributor to this issue may be California's educational standards for K-12. In California, state standards create structured approaches to students' learning. The standards provide important emphases on the sorts of knowledge that will prepare students for lives as informed adults. While such knowledge-based education serves a valuable function in equipping students with information, it seems at times to create barriers to developing their abilities in more substantive ways. The way in which the standards are measured seems to leave out critical thinking as an essential component of learning.

The general absence of critical thinking as an integral component of the educational standards is unfortunate, and the stakes could not be higher, particularly for a community like Coachella Valley, of whose population 55% are in traditional minorities and nearly 49% are Hispanic (Coachella Valley Economic Partnership). Research dating back to 1994 suggests that an education that includes extensive practice in critical thinking is even more essential to African-American students, and by extension, minority population groups that typically struggle with disproportionate rates of poverty (Webster 1994).

Moreover, given the low, 27% rate of students who enroll in a transferable course, improvement in critical thinking curricula has the potential to improve the performance of such students. Research by Bruce Torff suggests that low-advantage learners are often caught in a self-fulfilling prophecy in which their low-advantage positioning results in less exposure to critical thinking activities that might benefit them, with the result being a maintaining of their low-advantage status (Torff 2006).

Even if critical thinking will not "save the world," to quote George H. Hanford on the subject (1993), educators need to address this problem, because it has the potential to impact student populations dramatically. Given the demographic nature of the Coachella Valley, changes in educational practice can lead not just to improved student performance and success, but as an ancillary effect, to improvement in family success.

But to develop an approach to incorporating critical thinking into classroom practice, a definition of the concept needs to be in place. A bit of research will reveal that defining 'critical thinking' is a problem in and of itself. Despite the consensus regarding a definition of critical thinking that was claimed in the

early 1990s and the frequent use of the term, there seems to be a persistent problem with clear definition. In 1991, Joan S. Latchaw opined that 'critical thinking' had been "overworked, underanalyzed, and undefined." Six years later, a 1997 study in California found that only 19% of teachers could provide a clear explanation of what critical thinking is (Paul, et. al. 1997). As recently as 2009, studies have found that teachers often struggle to define critical thinking (Thurman 2009). In that eighteen-year span, it seems, little has changed. In effect, 'critical thinking' has become a buzzword that refers to equally vague terms, such as "problem solving" and "analysis."

These terms need explicit unpacking, and not just for students, but for teachers, too. The problem is that "critical thinking," "problem solving," and "analysis" are all terms that signify a complex body of processes and strategies for gaining a deeper, richer understanding of any given issue and advancing one's thinking about it. Labeling those complex processes with a simple and reductive term may name them succinctly, but doing so simultaneously conceals the myriad habits of mind being signified. While enumerating the complex processes in lieu of naming them collectively with a term like "critical thinking" is impractical, those complex processes need to be made explicit. As such, any definition for "critical thinking" needs to convey the multiple habits of mind the term conveys.

We suggest critical thinking is: *a meta-cognitive set of processes by which 1) individuals make sense of whatever topic one might address, 2) mature in capacity for reasoning, and 3) develop a conscious mind that employs knowledge of context (experience or other bodies of knowledge) to draw informed conclusions about subject matter.* Three key elements are implicit in this definition of "critical thinking":

- **Purpose** – Critical thinking is a means of producing knowledge from a position of patient questioning. It requires one refrain from drawing conclusions until one has made full observations towards achieving understanding of and solving problems.
- **Process** – Observation is the basis of a process of determining meaning by considering observations in light of *a consciously selected context*, be it personal, moral, critical, historical, or cultural. Our emphasis on awareness of choices in the process of determining significance is essential because students cannot control the direction of their thinking if they are not conscious of how choices can affect results.
- **Product** –As instructors, we share an interest in having students generate questions as a vehicle for uncovering varied levels of comprehension. Those questions become directive for students as they attempt to make meaningful observations about the texts they study. Additionally, each segment's educators challenge students to employ a sensitivity to context as a means of making sense of their observations. What 'context' means varies depending on the level of education. The university level, for example, seeks critical, social or historical contexts, while secondary educators employ personal contexts, although personal here often refers to students' experience with their own communities, and therefore a social context.

As noted in above, the product of critical thinking scales according to grade-level, so that what a freshman in high school strives to do differs from a freshman in college, whose goal is still less sophisticated than the senior in college. Generally speaking, we offer the following distinctions for each grade level:

- High school freshman year: Students should **acknowledge** that problems exist.
- High school sophomore year: Students should **identify** problems.
- High school junior year: Students should **research** problems successfully.
- High school senior year: Students should **evaluate** and **solve** problems, and **transfer** their learning.
- College: Students **use** knowledge and **explain** material successfully.

Even once ‘critical thinking’ and its related terms have been explained, the challenge remains to develop and implement a means of instructing students in these skills. As the attached bibliography demonstrates, there has been extensive exploration of the subject, often with the results suffering from dependence on the same catch-phrases of “problem solving” and “analysis,” a trait that undermines the potential effectiveness of the strategies offered. Moreover, critical thinking is not a set of simple mental tricks that can be taught in a semester, trimester, or quarter. Critical thinking is, rather, a set of mental habits that can only be developed over time and with ongoing reinforcement. Therefore, to best train students in the habits of mind that make up critical thinking, a consistent approach needs to be utilized to bridge the educational experience.

Developing new curricular strategies can be overwhelming. Applying existing and successful strategies removes these pressures. Instead, we can utilize a proven model, combining it with successful curricula. Sandra Kaplan’s Icons for Depth and Complexity, used in elementary GATE classrooms across California, are the bridge that can carry are students through the different educational segments. The icons offer a clearly defined structure that facilitates critical thinking by making explicit and naming the different constituent habits of mind. In what follows this introduction, we describe approaches to adapting the icons for and implementing them in secondary and post-secondary contexts.

Because the Icons for Depth and Complexity are not a stand-alone curriculum, they do not require the wholesale re-design of a teacher’s approach to students. The add-on nature of the icons allows teachers to maintain whatever curriculum they are accustomed to using. That being said, adopting the icons does present some challenges for teachers who work from established lessons or who have simply internalized their approach to the classroom.

None of the challenges are insurmountable. As we all know, any adjustment to practice comes with a period of uncertainty in which trial and error can be uncomfortable. Trying something new requires an investment of time and an acceptance of the uncertainty, as well as the occasional concerted effort to stop relying on familiar habits that have developed over years. We all have anecdotes about some success we have experienced by trying out something new and pushing through the discomfort. It is

worth pointing out that teachers who adopted the icons in trials often note that doing so did not just provide new anecdotes; it also rejuvenated them and renewed the excitement of teaching. Perhaps the biggest challenge to incorporating the icons is time. Teach long enough and you will develop go-to moves in the classroom and standard approaches to teaching personification or the quadratic equation, the American Revolution or the rotation of the earth. With large classes and piles of grading to complete, those habits save us time and allow us to instruct our students with reliable results. We can walk into the classroom knowing what we are going to do, roughly how it will go, and generally when students will have learned what we are teaching. Integrating the icons into practice can be a struggle as a result. If students are slow to pick up on what we're asking them to do with the icons (perhaps because we have not fully internalized them ourselves), then we can slip back into our habitual practices. It can be all too easy to fall into "how I've always done it."

One way of handling this possibility is to recognize where the icons are already in use. The great benefit of the icons is that they make explicit the habits of mind or the thinking strategies that scholars and teachers come to take for granted. If they make explicit, then that implies the habits of mind and strategies they promote are already part of our own teaching practices. For sure, each teacher will likely tend towards several that are most useful or of greatest interest. Nonetheless, we, as teachers, employ them in our existing lesson and assignments.

The task, therefore, is to make them explicit. To do so may require a patient review of our lesson plans and assignments, but the results are worth the effort. One teacher we know went through lesson plans with a green pen, drawing the icons in the margin wherever their strategies were being employed. He was surprised by two things: First, he discovered that his lessons drew on nearly every icon at various moments; second, he realized that his lessons could be strengthened by more consciously choosing what strategies to use and combine in each lesson.

What remains after making the icons explicit in practice—and in the revisions that often result—is to familiarize students with them. Students will need to be taught what the icons mean. This preparatory instruction benefits students greatly, because it introduces them not just to pictures that will be used in class, but also to directed ways of engaging with subject matter with increased sophistication. Teaching students the icons, therefore, teaches them strategies for critical thinking that they can apply elsewhere. Teaching them the icons teaches them how to learn—and how to become lifelong learners.

Due to the competitive and uncertain nature of entering higher education, particularly in a budgetary climate that sees reduced funding for remediation, attention to critical thinking in the classroom becomes essential. Students will benefit from greater exposure to and practice in critical thinking through regular exposure to the Icons. We strive to model for and teach our students these skills, but to maximize those efforts, we must determine how we use critical thinking in relation to standards-based curricula. If we can identify the ways in which critical thinking is practiced already, then we stand to draw our various approaches and strategies into alignment. To accomplish that, we must articulate **within each segment of education** how critical thinking can be implemented consciously and

systematically. The result will be students who can employ approaches to critical thinking in a world where critical thinkers are, sadly, disappearing.

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
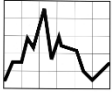
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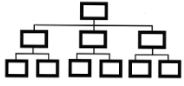





Icons for Depth and Complexity: An Overview






The Icons for Depth and Complexity were developed by Dr. Sandra Kaplan, Professor of Clinical Education at the University of Southern California, as tools for encouraging gifted students to engage more thoroughly with subject matter. The eleven icons promote more sophisticated exploration by isolating different means of entering into understanding of different subjects, topics, and texts. Students thereby gain not just deeper, more sophisticated knowledge, but also a toolbox of strategies for developing knowledge on their own. Because the icons identify generic ways of thinking or seeing, they are easily incorporated into virtually any subject (although math has seen the subsequent development of some discipline-specific icons).

Also included here are the icons developed as content imperatives. The five different content imperatives function similarly to the icons for depth and complexity, but there is an important distinction. Where the depth and complexity icons make ways of entering subjects explicit to students, the content imperatives provide students with ways of relating different areas of content. Sophistication of thought can be increased by combining icons, whether the combinations be of two or more depth and complexity icons, or depth and complexity icons and content imperative icons. The more icons are stacked, the more sophisticated the thinking. More on such uses can be found in Section D of this guide.

What follows here is a brief overview of each of icons. A table provides a succinct description of each icon while larger explanations follow. A variety of teaching tools for the icons can be purchased through J. Taylor Education (www.jtayloreducation.com).

Icon	Depth	Key Questions	Examples
 Language of the Discipline	<ul style="list-style-type: none"> Specialized vocabulary or nomenclature Skills and tasks specific to the discipline Tools used Benefit to society 	<ul style="list-style-type: none"> What terms or words are specific to the work of _____ (discipline)? What tools does the _____ (disciplinary) use? 	<ul style="list-style-type: none"> Describe the causes and effects of a historical event using the language of a sociologist, such as a group organization, group interaction, and group socioeconomic factors. (History)
 Details	<ul style="list-style-type: none"> Elaboration Identify Attributes Parts Factors 	<ul style="list-style-type: none"> What features characterize this? What are its attributes? What specific elements define this? What distinguishes this from other things? 	<ul style="list-style-type: none"> Describe the many and varied details that relate to this event. (History) State the details affecting the operations needed to solve this problem. (Math)
 Patterns	<ul style="list-style-type: none"> Identify recurring elements or events Determine the order of events Predict what comes next 	<ul style="list-style-type: none"> What are the recurring events? What elements, events, ideas, are expected over time? What was the order of events? How can we predict what will come next? 	<ul style="list-style-type: none"> Describe the pattern of erosion. (Science) Provide evidence to substantiate the pattern of the character's behavior. (English)
 Trends	<ul style="list-style-type: none"> Note factors (social, political, economic, geographic, environmental) that cause events to occur 	<ul style="list-style-type: none"> What ongoing factors have contributed to or influenced this study? 	<ul style="list-style-type: none"> Describe the changes in communication over time. Identify trends in the character's behavior.

	<ul style="list-style-type: none"> Identify patterns of change over time 		<ul style="list-style-type: none"> Describe the trend of climate change.
	<ul style="list-style-type: none"> Identify unclear ideas or missing information Discuss areas yet to be explored or proven Note conclusions that need further evidence or support 	<ul style="list-style-type: none"> What is still not understood or known about this area/topic/discipline? What ambiguities are there in this topic? In what ways is the information incomplete or lacking? 	<ul style="list-style-type: none"> Is global warming fact or fiction? Is war the solution for peace?
Unanswered Questions			
	<ul style="list-style-type: none"> State the explicit or implicit factors that govern an area of study The structure / order / hierarchy The elements that set the standard 	<ul style="list-style-type: none"> How is this structured? What are the stated or unstated causes related to the description or explanation of what we are studying? What does this situation or context require? 	<ul style="list-style-type: none"> Describe the implicit and explicit rules of the water cycle. Define the consequences of the intended and unintended rules governing behavior of the major characters.
Rules			
	<ul style="list-style-type: none"> Identify value laden ideas Determine elements that reflect bias, prejudice, discrimination State pro and con arguments in terms of ethics 	<ul style="list-style-type: none"> What dilemmas or controversies are involved in the area / topic / study / discipline? What elements can be identified that reflect bias, prejudice, and discrimination? 	<ul style="list-style-type: none"> How do the ethics of the character define who he is? Explore the rules (if any) that the media follows to get a story.
Ethics			
	<ul style="list-style-type: none"> Identify a rule or general statement that summarizes information or draws a conclusion based on evidence drawn from a collection of facts or ideas Locate the thesis in a written argument or analysis 	<ul style="list-style-type: none"> What overarching statement best describes what is being studied? What general statement includes what is being studied? 	<ul style="list-style-type: none"> Define the meaning of the statement "change is inevitable" by studying changes in the environment, government or portrayal of a character.
Big Ideas			
Complexity Key Questions Examples			
	<ul style="list-style-type: none"> Describe relationships between past, present, and future Describe the relationships within a time period Explain how or why things changed or remained the same 	<ul style="list-style-type: none"> How are the ideas related between past, present, and future? How are these ideas related within or during a particular time period? How has time affected the information or situation? How and why do things change or remain the same? 	<ul style="list-style-type: none"> Compare changes in life styles from the time of your parents' teenage years to the teenagers of today. Make a timeline of the history of the United States.
Over Time			
	<ul style="list-style-type: none"> Discuss multiple perspectives related to an area of study Explore opposing viewpoints (pros & cons) Reflect on the advantages of diversity within a society 	<ul style="list-style-type: none"> What are the opposing viewpoints? How do different people and characters see this event or situation? 	<ul style="list-style-type: none"> Analyze the pros and cons of sweet drinks being sold at school. What are mathematicians' viewpoints on the metric system versus the standard system of measurement?
Different Perspectives			
	<ul style="list-style-type: none"> Relate/integrate the area of study to include the methodology of other disciplines Describe a topic's place in more than one discipline or subject area 	<ul style="list-style-type: none"> How do experts in a discipline learn from experts in other disciplines? How do different people and characters see this event or situation? 	<ul style="list-style-type: none"> How is human behavior expressed through music and history? How has history affected art over time? How has technology affected literature?
Across Disciplines			

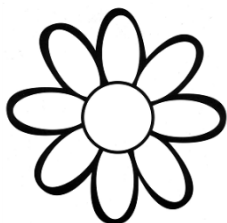
	Content Imperative	Key Questions	Examples
 Origins	<ul style="list-style-type: none"> • Explain the source of an idea, event, situation, phenomenon or statement • Describe how something got started or began 	•	<ul style="list-style-type: none"> • Explain the origins of the theory of Manifest Destiny. • Explain what causes the formation of a volcanic caldera.
 Contribution	<ul style="list-style-type: none"> • Explain the implication of a fact, detail, context, event, or statement • Observe the effect or benefit of some action or attribute 	•	<ul style="list-style-type: none"> • Explain how natural climate cycles contribute to global warming. • Explain how Neo-Platonism shaped Augustine's theology.
 Convergence	<ul style="list-style-type: none"> • Explain how sets of details can combine to create complex effects or meanings • Observe how ideas meet to form new or different ideas 	•	<ul style="list-style-type: none"> • Explain how Enlightenment theories of human nature, liberty, and governance combined in colonial America. • Explain how setting, characterization, and plot combine to create theme.
 Parallel	<ul style="list-style-type: none"> • Explain how areas of study share common characteristics • Observe how contexts, situations, events, texts, objects, and environments are similar 	•	<ul style="list-style-type: none"> • Explain how science and history use similar approaches to producing knowledge. • Explain how poetry and prose employ common approaches.
 Paradox	<ul style="list-style-type: none"> • Explain how things can display opposing or contradictory ideas • Observe the presence of binaries in contexts, situations, events, texts, objects, and environments 	•	<ul style="list-style-type: none"> • Explain what makes the French and American revolutions distinct from one another. • Explain how American laws simultaneously promoted and suppressed racial equality.



Language of the Discipline

The *Language of the Discipline* icon can be thought of in two distinct but related ways. It encourages students to learn and then use terminology that is distinctive to a given discipline, and thereby address the subject matter as practitioners do.

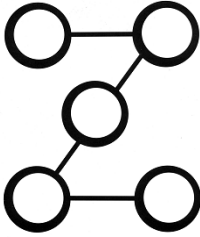
But that move, to use the terms as practitioners in the discipline do, implies the second way of thinking about the icon. Discipline-specific terminology also functions as identifiers for tools specific to a field. Thus, *Language of the Discipline* also gives students sets of specific tools for engaging in a specific field of study. For example, in literary studies, 'personification' is a key term that sensitizes students to a particular type of figurative language and the effect it has on meaning. Similarly, in the sciences, 'hypothesis' is a key term that implies a process, that of formulating initial ideas that will be tested. Moreover, the icon can be used to focus students on rhetorical ideas associated with critical thinking, such as the *ad hominem* argument or the rhetorical implications of *ethos*, *pathos*, and *logos*.



Details

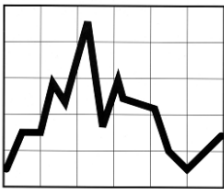
The *Details* icon focuses students on paying careful attention to whatever they might be studying and aims at making them careful observers. The icon can also

be used to engage students in one of the key steps of analysis, the identification of significant parts constituting a whole. The icon's shape is useful, since the center of the flower serves as a space in which to name whatever will be described. Each of the petals then offers space in which to record individual details about the thing being described. The flower motif also allows teachers to encourage students to develop bouquets. For example, students might use one flower to describe the clothing of a character, another to describe the physical features of that character, and third to describe the character's actions. The bouquet will yield a more comprehensive picture and encourage students to be even more careful observers of detail.



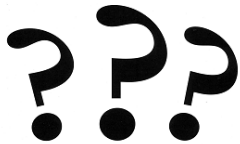
Patterns

The *Patterns* icon also has two somewhat distinct uses. First, it can be used to focus students on tracing sequences of occurrence in what they are studying. In this use, students can be asked to document an order of events, such as in scientific or natural processes (the water cycle), historical events (links between economic pressures and socio-political revolutions), mathematical procedures (proofs in geometry), or literary plots (archetypal narrative structures). In its other use, the icon encourages students to identify repetitions of detail—another of the important steps of analysis. In this use, students can seek out repeated imagery (such as themes of light in a poem), ideas (such as the emphasis on human liberty during the American colonial era), or phenomena (such as floods, storm surges, and tsunamis) as a way of organizing knowledge in meaningful ways.



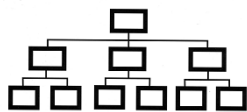
Trends

The *Trends* icon focuses students on considering how things change over time and what factors might induce those changes. To that end, this icon tends to work in line with both the *Patterns* depth icon and the *Over Time* complexity icon. It is distinct from the *Patterns* icon, because it considers not general patterns of sequence, but more specific instances of change. It is distinct from the *Over Time* icon, because it considers more prescribed moments rather than how similar ideas or issues differ in different times. For example, the *Trends* icon might be used to ask students to consider the development of the Civil Rights movement and to identify the different figures and events that caused it to advance.



Unanswered Questions

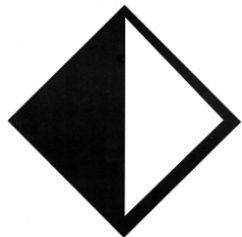
The *Unanswered Questions* icon encourages students to be both explorers seeking more information and also keen observers capable of identifying where more information is still needed to formulate complete explanations of whatever they are studying. The questions can target gaps in knowledge or information, but they can also identify ambiguity.



Rules

The *Rules* icon prompts students to be aware of the principles that govern an area of study. These might be such things as the scientific method, which prescribes a sequence for investigation, mathematical laws, or rules of grammar. Alternatively, the icon conveys structural principles, such as the

structure of a plant cell, the regularity of isosceles triangles, or the form of literary genres. The *Rules* icon can also be used to focus students' attention on even larger structures and hierarchies, such as ecosystems, systems of government, and cultural archetypes.



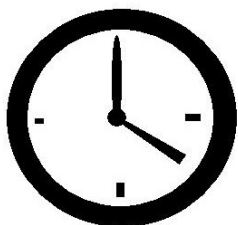
Ethics

The *Ethics* icon may seem straightforward, since it obviously asks students to consider the ethics of a situation. The situations and ethical questions, however, can generate great variety in how the icon affects an investigation. Students can be challenged to examine their own ethical positions as they relate to a given topic, such as animal rights. They can also be asked to evaluate the ethical choices made by others, such as characters in novels or historical figures. As yet another use, students can define the different ethical positions that might arise from a particular set of circumstances. For example, without taking a position themselves, they might describe the variety of ethical views that relate to the dropping of the nuclear bombs on Hiroshima and Nagasaki.



Big Ideas

The *Big Ideas* icon engages students in establishing, defining, or identifying significant ideas. Where those significant ideas derive from can vary, making the icon useful for an array of uses. Most obviously, the icon can direct students to recognize a major idea, such as photosynthesis or the transitive property or Locke's *tabula rasa*. Alternatively, the icon can be used to challenge students to identify a big idea as a response to a text. In this usage, patterns or constituent ideas are represented in the columns, supporting the overarching idea, in the triangle. Yet another use is to focus students on thesis statements in their own writing (or the writing of others). Topic sentences that support the thesis are placed in the columns with the thesis occupying the triangle.



Over Time

The *Over Time* icon encourages identification of complexity by recognizing that time can affect an object of study. "Over Time," however, can mean either change over time or continuation over time, so that consideration of both similarity or difference (using, perhaps, the parallel or paradox icons) are potential avenues for examination. Students can, therefore, explore how cultures, technology, or arts, for example, develop from era to era while considering what remains consistent in each of those. The *Over Time* icon can also be used to stimulate thought about a student's own progression of learning. For example, students can be asked to analyze their own writing and reflect on how their work has changed over the course of a term.



Different Perspectives

The *Different Perspectives* icon challenges students to develop more complex understanding by considering how an object of study changes depending on the

viewer. The point of view may encompass social, cultural, political, or geographical distinctiveness, so that students are encouraged to consider a topic outside their spheres of familiarity or outside their 'comfort zones. Alternatively, specific areas of study might find more particularized uses. In literary studies, students can be asked to consider the conflict of a given text from the perspectives of multiple characters. In the social sciences, this concept might encompass the principle that observation alters the observed. In the hard sciences, *Different Perspectives* might be used to address the variability of explanations for scientific data that make up scientific debates. More specific to students, themselves, the icon can be used to ask students to reflect on the effectiveness of their writing in relation to the audience to whom they have written.



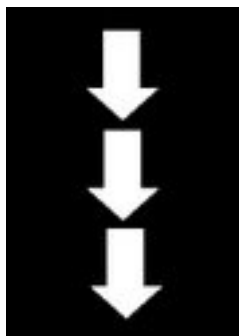
Across Disciplines

The *Across Disciplines* icon can be utilized in a variety of ways. First, it asks students to think about how a given topic of study or object of investigation might be relevant in disciplines other than that in which the topic or object is first investigated. For example, Darwin's theories of evolution might be introduced in a biology course, but students might be challenged to think about how those theories impacted sociological discussions. Alternatively, an English class might discuss learn about rhetorical forms, while a history course might consider a famous speech by, in part, drawing on awareness of those forms. Second (and this is just the reverse of the coin), this icon can be used to explore what light an outside discipline might shed on a given topic. For example, an English course might examine the ways in which historical context informs understanding of a literary text. This approach is akin to contextualized learning, so that a math teacher might utilize engineering principles to reinforce algebra by asking how many cars a given bridge can hold.



Origins

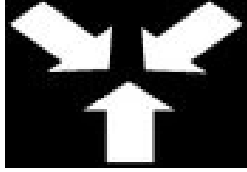
The *Origins* icon encourages students to develop an awareness of how a given idea, phenomenon, or event emerged. Thus, the icon directs attention to the various factors that contribute to such ideas, phenomena, or events, or to the contexts in which they develop. The multiple arrows can be used to think, too, about the variety of effects that can result from a given set of circumstances, whether historical, mathematical, scientific, or cultural. Positioning the *Origins* icon right side up or upside down can increase its utility. As pictured to the left, the icon prompts students to think about how an originary idea, phenomenon, or event yields various effects. Upside down, the icon prompts students to examine the way in which a variety of ideas, phenomena, or events might converge to create a single effect.



Contribution

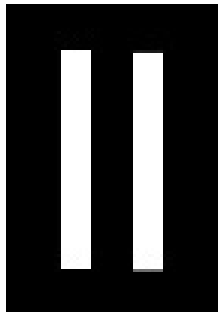
The *Contribution* icon assumes that any given idea, event, or phenomenon derives from a complex of factors or components. Instructors can use the icon to encourage students to identify the various factors or components as well as develop conversancy with a single one. As a result, this icon asks students to think about what a given factor contributes to the overall idea,

event, or phenomenon. The *Contribution* icon can also be used to direct students to the implications of a given statement or idea, since it highlights the yield of an idea, event, or phenomenon.



Convergence

The *Convergence* icon focuses student thinking around the combined impact of a variety of ideas, phenomena, or events. If the *Contribution* icon (above) is used to isolate a single factor or its implications, then this icon is redirects attention to the combined effect of multiple factors. Instructors can use the icon to draw together students' thinking as they study an object of investigation to formulate an explanation for it. For example, students might be asked to use the *Details* and *Patterns* icons to generate initial observations about what they are analyzing. The *Convergence* icon can then be introduced to ask students to consider how the details and patterns work together to produce some ultimate effect.



Parallel

The *Parallel* icon encourages students to think in terms of similarity. As such it is most obviously useful when teachers are working with students on comparison of events, ideas, or phenomena. For example, history teachers might use the icon to prompt students to consider the ways in which the revolutions of the Arab Spring are comparable to the American Revolution. By turning it ninety degrees, the icon becomes an equal sign, allowing for teachers and students to determine more nuanced degrees of similarity. In this strategy, students can identify elements of the compared ideas, events, or phenomena that appear to be identical as well as elements that resemble one another but are not identical.



Paradox

The *Paradox* icon encourages students to think in terms of difference. To that end, it is useful when teachers work with students on contrasting events, ideas, and phenomena. Thus, biology teachers might use the icon to focus students on the ways in which plant cells differ from animal cells. When combined with the *Parallel* icon, students are given visual cues for the traditional compare and contrast type of assignment, and when the *Big Idea* icon is added, that assignment can be given purpose. The *Paradox* icon can also be used to help students to think about the presence of binary structures in objects of study. For example, teachers might challenge students to think about how a poem draws on imagery of both light and dark or, on a more advanced level, how a speech or literary text uses traditional forms while at the same time subverting them.

Strategies for Using Icons

Possible Sequences of Icons in Conjunction with Bloom's Taxonomy

The various levels of Bloom's Taxonomy often appear to be a list of simple actions, but when one considers how to complete any of those actions, a different impression emerges. The different levels of Bloom's Taxonomy are actually complex modes comprised of different intellectual tasks. The higher up the taxonomy one moves, the more complex the combinations of those tasks.


















































The chart below offers a way of making explicit the sequence of intellectual moves that comprise any given level of the taxonomy. In looking at the table, two key factors should be kept in mind. First, each combination is only one way of combining the icons to reach the desired level of the scale. Numerous other possibilities exist for recombining the icons differently to achieve the same ends.

Second, Bloom's Taxonomy should not be considered a single, linear path of development that maps simply to a student's development from K through college. Rather, the taxonomy should be considered a cycle that students are passing through all the time. They will move from knowledge to analysis to evaluation to synthesis with varying degrees of complexity throughout their educational careers.

Note, too, that the various combinations of icons feature a repetition of a single icon. For example, in the *Synthesis* string, the *Big Idea* icon appears twice (or more, given the need to repeat the first part of the sequence). Those repetitions suggest either moments in the intellectual process that require a summation of thinking before moving on to next stage or moments in which a recursive process is required.

In some cases, a variety of icons are suggested as potential parts of a given sequence, such as in *Application*. In these instances, the given direction of the application is flexible, and students can be given multiple potential areas of application. The end goal of the instructor will ultimately determine which of the possible areas of application will be most useful.

Teachers may find it useful to develop their own approaches to combining and recombining the icons. As the authors of this guide collaborated on the chart below, we discovered that thinking through the levels of learning as processes comprised of the strategies named by the icons caused us to become much more sensitive to just how complex the higher levels of learning actually are. Moreover, we found that our pedagogical approaches broadened by experimenting with alternative sequences of icons.

Bloom's Level	Sequence of Icons
Synthesis	 +  +  +  (repeat) +  + 
Evaluation (determine relevance)	 +  +  or  +  or 
Evaluation (judge with criteria)	 +  +  +  +  or 
Analysis: explain w/ evidence	 +  +  +  + 
Analysis: compare/contrast	 +  +  +  + 
Analysis: note ambiguity	 +  +  + 
Analysis: define cause	 +  +  + 
Analysis: define effect	 +  +  + 
Application	 +  or  or 
Comprehension Sequence	 + 
Comprehension: Categorize	 + 
Knowledge: summary	
Knowledge: definitions	