Higher-Order Thinking

The Multiple Intelligences Way

David Lazear

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Preface

In high school I had an English literature teacher named Mrs. Callie Milstead. She stubbornly maintained that just being able to remember the information presented in class and in our textbooks did not mean we had really learned it. I could never understand what she meant. If I could recall the information to answer questions on a test, then surely I had mastered it! Nonetheless Mrs. Milstead would constantly pester us to find relationships between the bits and pieces of information we were so skilled at reproducing on call. She would ask us to analyze and understand underlying processes and dynamics of the content she was teaching—the writing process; the process of grammar, syntax, and semantics in literature; the dynamic process of a classical Shakespearian drama; and so forth. Her constant refrain was, "If you can't tell me how what we're studying applies to you in your everyday life, then I don't care if you can answer every question with 100 percent accuracy on a test, you don't understand the material! If you can't apply it, you haven't learned it!" Given this definition of learning, I did very little real learning in my formal educational career.

When I was sitting in Callie Milstead's classes, no one was talking about such things as higher-order thinking, metacognition, understanding and developing skillful patterns of thinking, graphic organizers, or cognitive maps. But Callie Milstead was doing it nonetheless. And we learned! We learned how to apply what we were studying. We learned how to transfer insights from English literature to other areas of the curriculum. We learned how to integrate what we were studying into our lives to such an extent that a great deal of it is still with me today.

Callie Milstead was also a master at employing multiple intelligences, although again, that terminology did not yet exist. Howard Gardner had not yet coined the phrase "multiple intelligences" to describe the many different ways we remember what we know, process information, acquire knowledge, learn, and understand. Nevertheless, Mrs. Milstead's classes were multimodal to the hilt! We could never second-guess her. When we entered her classroom we never knew what to expect, other than that whatever we did would delight us, and would be interesting and challenging. We knew our minds would be stretched during that class hour, and that our lives would be touched in ways that would affect us many years into the future.

In some ways, the way Callie Milstead taught is the epitome of what effective teaching has always been. Good teachers have always known that to reach all students, *everything* has to be presented in a wide variety of ways. Good teachers have always known that the proof of the learning comes "when the rubber hits the road," so to speak, not in reproducing answers on some out-of-context test.

Today we have an immense body of research about the human thinking and learning processes and how to improve them; in fact, we know more about what is effective for teaching and learning than humans have ever known. Our increasingly complex world is also urgently requiring that we be multimodal creatures who think at higher-order levels. Given the state-of-the-art research behind our profession, there is no reason to spend time on anything but lessons and units that challenge students to think at higher-order levels and that genuinely prepare them to assume leadership roles in the future.

I dedicate this book to all the Callie Milsteads of our world—past, present, and future. They are the teachers who always have, are still, and always will ensure that "no child is left behind," not only in school but in their lives beyond the walls of formal education!

David G. Lazear
Maui, Hawai'i
Spring 2003

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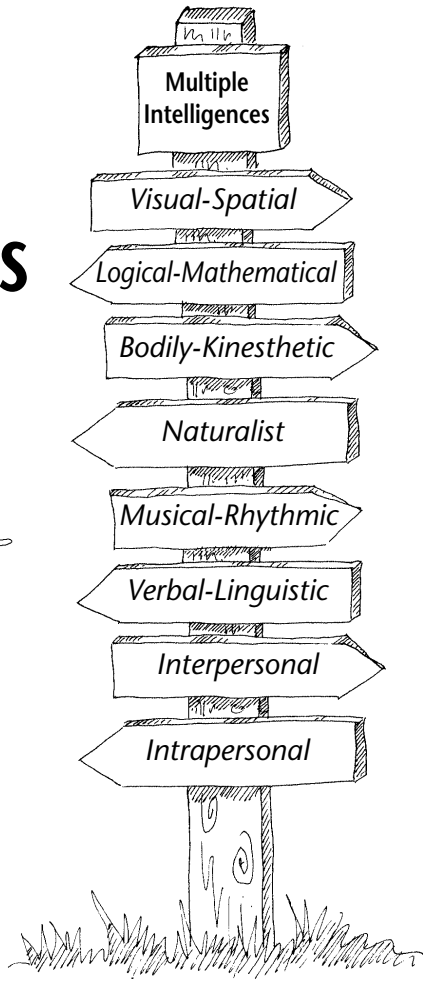
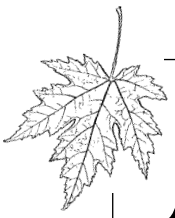
Moving Students' Intelligences to Higher-Order Realms



We must finally admit that process is the content. If we want students to develop certain behavioral characteristics—taking a critical stance with their work, inquiring, thinking flexibly, learning from another person's perspective—then we should start with those attributes and focus the entire curriculum on achieving them . . . The core of our curriculum must focus on such processes as learning to learn, knowledge production, metacognition, transference, decision-making, creativity, and group problem solving. These are the subject matters of instruction.

—Art Costa, *Developing Minds*



A group of middle school students are involved in a unit on the process of photosynthesis, learning about the parts of a plant, how they function, and the role each part plays in the larger photosynthesis process. In expert groups, they have used colored markers to create large posters that illustrate each part of the plant and its role in the life of the plant. One group has drawn a cross section of a plant's leaf system, another group has illustrated the workings of the root system, another the plant's reproductive system, and so on, with the functions of each system appropriately labeled. The teams are now sharing their posters with the whole class, explaining the inner workings of their respective part of the plant. The posters are colorful, imaginative, visually appealing, and instructive.

The teacher asks the teams to post their drawings at the front of the class. He explains, "We now have some drawings that represent the basic functions of the parts of a plant. Now we are going to put them together and understand the relationships and dynamics between these parts." He proceeds to give a mini-lecture (based on information from the science textbook) explaining what goes on at each stage of the photosynthesis process:

> *Step one of the process: The rays of the sun strike the plant. This causes the chlorophyll in the plant to turn toward the sun. The chlorophyll grabs the sun's energy and uses it to split the water molecules inside the leaf.*

He then asks the class to think of fun and creative images, patterns, designs, symbols, and pictures they could add to the leaf system poster to show the chlorophyll turning toward the sun to capture its energy. As the students have ideas, they come to the front of the class and draw them on the poster. One student draws little green solar panels on the surface of a leaf. Coming out of the solar panels are funny hands that are grabbing the rays of the sun. Another draws green satellite disks turning toward the sun.

As the instruction continues (using the process of mini-lecture followed by a pause to illustrate each concept), some students begin to draw symbolic connections between the plant's various systems, such as a complex of pipes running from the root system to the leaf system or tiny water trucks traveling along the plant's stem to deliver the water to the leaves. Students have fun finding unusual ways to illustrate the various steps of photosynthesis, and the pictures, shapes, images, designs, and patterns they draw on the posters demonstrate a great deal of understanding of how the different parts of the plant interact during the photosynthesis process.

In the final stage of the lesson, each student receives an 11" x 17" sheet of white construction paper. The class is instructed to imagine they are abstract artists creating a painting for the Museum of Modern Art, entitled *The Process of Photosynthesis*. Using colored markers only, they are to create something that illustrates the process. No words are permitted on their creations! They must tell the story through shapes, images, patterns, colors, designs, and visual symbols.

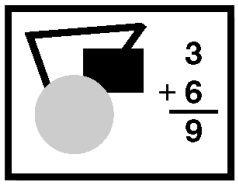
What you have just read is an example of using multiple intelligences (in this case visual-spatial intelligence) to facilitate higher-order thinking and reasoning in students. As with any higher-order thinking task, the key is to move students from thinking about "the facts, ma'am, nothing but the facts," to understanding the dynamic relationships among the facts and the various processes involved, then to the level of synthesizing, integrating, applying, and transferring the learning. It is at the last level that learning is internalized, is invested with meaning, and becomes part of one's being.

What I have just described is a much simplified version of Benjamin Bloom's now-famous taxonomy of cognitive abilities (Bloom 1956). In my opinion, Bloom's taxonomy is still the best model we have for what is involved in logical-mathematical thought. However, I propose (1) that each of the eight intelligences possesses a unique taxonomy of cognitive abilities, and (2) that educators need to use all the intelligences at their respective higher-order levels in order to promote a deep level of learning and mastery of the curriculum in their students.

When teachers first adopt a multiple intelligences approach to teaching, many use the intelligences either simply to spice up otherwise dry lessons or as mnemonic devices to help students remember certain facts and figures. Of course, the entertainment value of a lesson will certainly be higher when teachers use multiple intelligences in teaching and learning, and this approach will most certainly aid students in remembering the information. From the perspective of the full range of cognitive abilities each intelligence represents, however, such a use of multiple intelligences is akin to never moving beyond the information recall levels of Bloom's taxonomy. In contrast, a deep understanding of the multiple taxonomies of multiple intelligences provides a way to help students think at higher levels in and through the different intelligence domains.

Logical-Mathematical Intelligence Taxonomy

It's as Simple as One, Two, Three

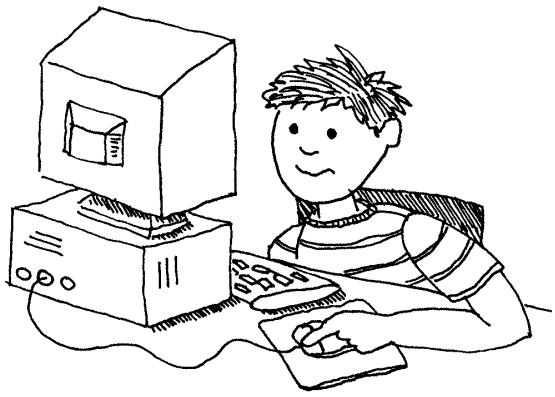


A mathematician, like a painter or poet, is a maker of patterns. If [the mathematician's] patterns are more permanent than theirs, it is because they are made with ideas . . . the mathematician's patterns, like the painter's or poet's, must be beautiful; the ideas, like the colors or the words, must fit together in a harmonious way.

—G. H. Hardy, quoted in *Math for Humans*

For most of us, one of the quickest ways to raise our stress level is to mention mathematics. Many of us associate math with pain. I am still surprised at the number of stories I hear from people in workshops who talk about their scars from inappropriate math tactics applied by well-meaning teachers. In a 1976 article in *MS Magazine,* Sheila Tobias popularized this phenomenon by calling it "math anxiety" (cited in Wahl 1997). Due to the way math is taught in school, we often fail to fully tap the power of this intelligence. A good example is a friend of mine who barely made it through his required math courses in high school. Yet today he is a nuclear engineer in a large East Coast nuclear power plant. Guess what he spends 95 percent of his day doing? Precisely the same math with which he had difficulty in school. But now he does math in context. Now it makes sense because it's relevant to his life in the real world.

In other books I have written I have called the logical-mathematical intelligence the pattern-seeking intelligence. It seeks every conceivable pattern: number patterns, thought patterns, color patterns, traffic patterns, relationship patterns, visual patterns, and so on. It always begins with concrete patterns in the real world, but logical-mathematical thought becomes increasingly abstract as we try to understand relationships in the patterns we have seen. We try to find answers to problems based on or created by the patterns. At this point we resort to using abstract symbols



(such as numbers) to represent patterns we have experienced, to making calculations such as cause and effect or hypotheses, or working with various mathematical formulas to figure out everything from how much paint we need to change the color of our bedroom to how much to tip a server in a restaurant, to figuring out a budget for our family vacation.

For many of us, if math had been taught in context in school, we would have done a lot better and likely would have avoided much of the math anxiety Sheila Tobias discussed. In fact, according to the child development research of Piaget and Inhelder (1969), the earliest developmental stage of what we now call logical-mathematical intelligence is manipulation of and play with a variety of concrete objects in the physical environment and the ability to recognize familiar, previously manipulated objects placed among a range of unfamiliar objects. Children develop the capacity to recognize familiar objects in pictures and to pick those objects out of other pictures containing many other objects that are unfamiliar. Eventually, they are able to imagine objects they have manipulated when those objects are not physically present. This intelligence becomes increasingly abstract and symbolic as it develops. Later in their development children learn about numbers, which are simply abstract symbols representing concrete patterns they have observed. Numbers are what mathematicians call "pure abstractions" because they can be applied to a wide range of objects; namely, you can have 3 women, 3 boats, 3 clouds, 3 mountains, 3 butterflies, and 3 gusts of wind. There are no limits to the 3 symbol. There is no content to the 3 symbol. In and of itself it has no meaning. It gains its significance when used to represent concrete patterns.

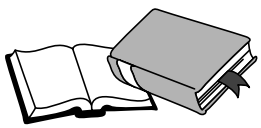
Overview of the Logical-Mathematical Taxonomy of Cognitive Abilities

The unique language of the logical-mathematical intelligence is the language of patterns. These recurring patterns include not only traditional mathematical patterns involving numbers, fractions, ratios, or geometric shapes and designs, but also word patterns, visual patterns, sound patterns, even patterns of people or animals. Another feature of logical-mathematical intelligence is patterns of effective problem solving, thinking, and strategizing to meet new challenges. Work with the cognitive abilities for this intelligence involves knowing, analyzing, and processing information in and through the many recurring patterns that surround us in our world and universe. As I mentioned earlier, I feel that Bloom's taxonomy is still the best model we have for understanding the cognitive abilities of the logical-mathematical intelligence.

Using the Object-Free Intelligence Taxonomies: Example Units

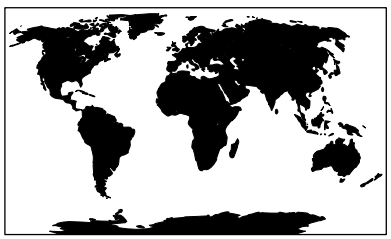
The following section outlines three units that illustrate how to move students' thinking to higher-order realms using the object-free intelligences. There are three units, one each appropriate for elementary, middle, and high school. These outlines or synopses are *not* intended to give every detail or enumerate every lesson that would be involved in a given unit. Likewise, I am not suggesting that anyone *should* do these units. Rather, my goal is to illustrate how to use the taxonomies of the object-free intelligences systematically to move students to the higher-order use of the related intelligences and to a higher-order understanding of key curricular concepts. Whether or not your curriculum deems the content I have included to be key concepts is not the point. The point is to show how to use multiple intelligences to get students thinking at higher-order levels in any unit of instruction.

It is not necessary to follow my suggestions in the order listed, although a unit will likely begin with the level of gathering and understanding the basic knowledge (or concepts) of the unit and move up the taxonomies to the higher-order thinking and reasoning level. Although you may not use all the suggestions for each level of the taxonomy, I would suggest you try to balance the learning activities and tasks among the two object-free intelligences.



Exploring the Continents of Our World

A Sample Elementary Geography/Social Studies Unit



In this elementary geography/social studies unit, students study the continents using musical-rhythmic and verbal-linguistic intelligences. The unit begins with students compiling basic information about the continents. Next they analyze and research assigned continents. In the final part of the unit, they reflect on the gifts and contributions to the world that come from each continent. The various intelligences and levels of the cognitive taxonomy being tapped are inserted in the outline in bold and summarized in table 12 (page 68).

- Students learn the names of the continents, listen to songs from various continents, then modify the lyrics from one to create a song incorporating the names of the continents and one distinguishing characteristic of each one. **(musical-rhythmic intelligence, gathering and understanding basic knowledge)**
- Divide the class into seven groups and assign each one a continent, or have them draw the name of a continent out of a hat. (To allow for more groups, you could have an eighth group research the island nations of the South Pacific.) Give each group a fact sheet containing key information the students need to learn about their assigned continent. They study the facts in their groups, then compose a poem about their assigned continent. The poem is to use the information they have studied and present it in such a way that someone reading the poem would learn key information about the continent. They then share their poems with the rest of the class. **(verbal-linguistic intelligence, gathering and understanding basic knowledge)**
- Have the continent groups further analyze and research their assigned continent, maybe via Internet searches to learn information about such things as climate, geological features, population, religions, animals, customs, food, economic base, and vegetation. They turn their research into an audio tape recording, perhaps in the form of an old-time radio show. The recordings are to be complete with appropriate sound effects, background music, and people speaking the language(s) of the continent. The goal is to give listeners an auditory experience of the continent. **(musical-rhythmic intelligence, analyzing and processing information)**

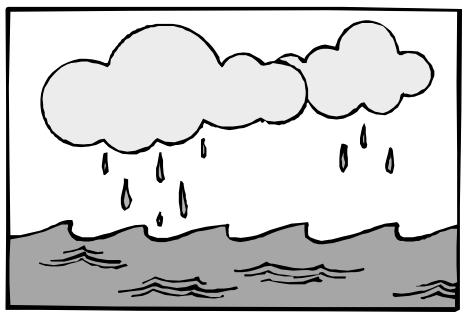
Using the Personal Intelligence Taxonomies: Example Units

The following section outlines three units that illustrate how to move students' thinking to higher-order realms using the personal intelligences. There are three units, one each appropriate for elementary, middle, and high school. These outlines or synopses are *not* intended to give every detail or enumerate every lesson that would be involved in a given unit. Likewise, I am not suggesting that anyone *should* do these units. Rather, my goal is to illustrate how to use the taxonomies of the personal intelligences systematically to move students to the higher-order use of the related intelligences and to a higher-order understanding of key curricular concepts. Whether or not your curriculum deems the content I have included to be key concepts is not the point. The point is to show how to use multiple intelligences to get students thinking at higher-order levels in any unit of instruction.

It is not necessary to follow my suggestions in the order listed, although a unit will likely begin with the level of gathering and understanding the basic knowledge (or concepts) of the unit and move up the taxonomies to the higher-order thinking and reasoning level. Although you may not use all the suggestions for each level of the taxonomy, I would suggest you try to balance the learning activities and tasks among the two personal intelligences. Remember that the personal intelligences tend to use all the other intelligences in the act of relating to and with other people and reflecting on the self, so it is fine to have students draw pictures, act things out, sing, or write an essay as long as the focus is on enhancing the knowing that occurs through interpersonal relating and intrapersonal introspection!

Understanding the Water Cycle

A Sample Elementary General Science Unit



In this unit students learn about the water cycle and why and how it is important for life on our planet. For most of the unit, students work in cooperative groups, then do personal reflection on what they have learned in their groups. For the analyzing and processing information segments of the unit, you will need some way to give students a virtual experience of the entire process of the water cycle, from the raindrop falling initially to its eventual return to the atmosphere (see the tips on page 90 for suggestions). The final stage of the unit examines how the water cycle is in jeopardy today due to humans' lack of care for this vital resource. The intelligences and levels of the cognitive taxonomy being tapped are inserted in the outline in bold and summarized in table 17 (page 91).

- The unit begins with students learning the basic vocabulary needed to discuss the water cycle, including definitions of the various stages. They look up the dictionary or textbook definitions; then, in cooperative groups, they rewrite the definitions in their own words. They also create illustrations to accompany the definitions. **(interpersonal intelligence, gathering and understanding basic knowledge)**

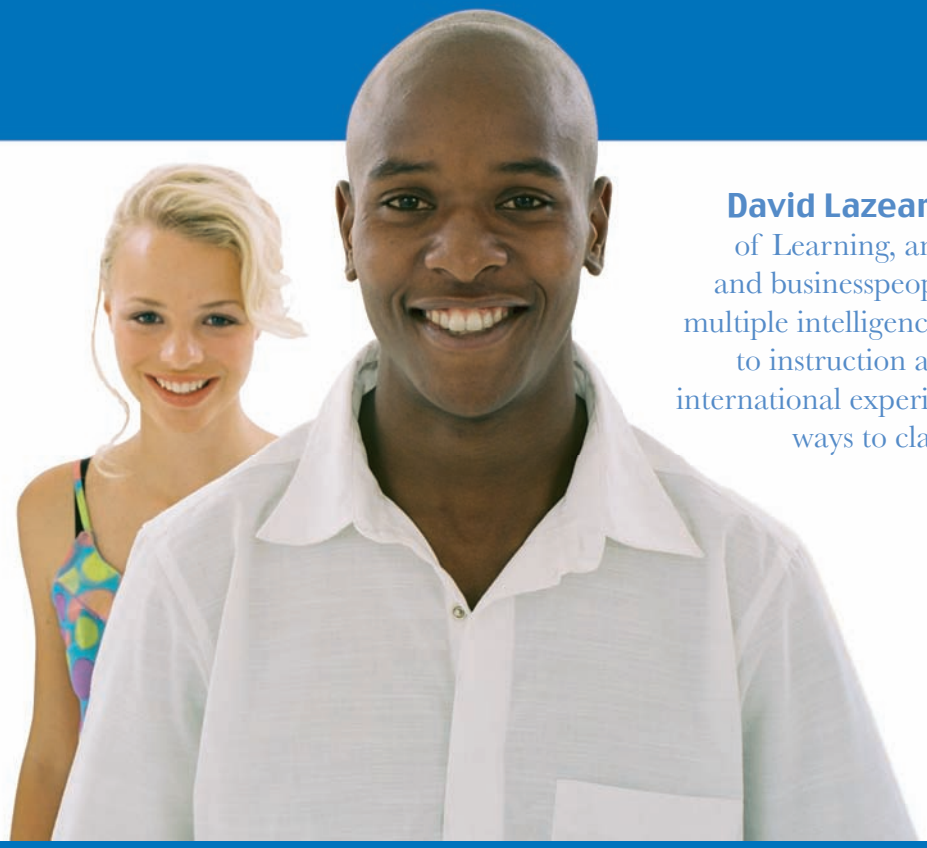
- Students close their eyes and remember experiences they have had with water. They pretend they have a television inside their heads on which they can view a movie of their water experiences. After several minutes of this inner remembering, each turns to a partner and describes the experience, *using the newly learned vocabulary words* to relate the experience. **(intrapersonal intelligence, gathering and understanding basic knowledge)**

- After a "virtual experience" of the water cycle (see "Tips and Preparation for Presenting the Unit" on page 90), divide students into expert groups, with each group assigned to one stage of the water cycle. In their expert groups, they are to take their assigned stage and learn as much as they can about it. Team members are given assignments such as doing Internet searches, going to the library, and interviewing other people to investigate thoroughly the stage they have been assigned. Each expert group prepares a report on what they have discovered in their investigations and shares it with the rest of the class. **(interpersonal intelligence, analyzing and processing information)**

Higher-Order Thinking The Multiple Intelligences Way helps you discover how to move past the traditional 'memorize and regurgitate' method of education. It uses the eight intelligences to move students' learning from the level of acquiring basic facts and figures, to the level of understanding relationships between those facts and figures, to the higher-order level of application, integration and transfer of the material being studied.

With **Higher-Order Thinking The Multiple Intelligences Way** you will…

- Learn how to analyze the thinking levels of a lesson
- Discover how each intelligence processes information
- Gain insight into multiple taxonomies for the Multiple Intelligences (MI)
- Experience nine example lessons showing how to use the MI taxonomies at primary and secondary levels
- Learn how to 'spiral' a lesson so that it is developmentally and cognitively appropriate
- Give students a battery of tools for success in school and beyond



David Lazear is the founder of New Dimensions of Learning, an organisation that trains educators and businesspeople to apply cutting-edge research on multiple intelligences and other brain-friendly approaches to instruction and business. He has many years of international experience in applying MI theory in practical ways to classrooms, schools and business.

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