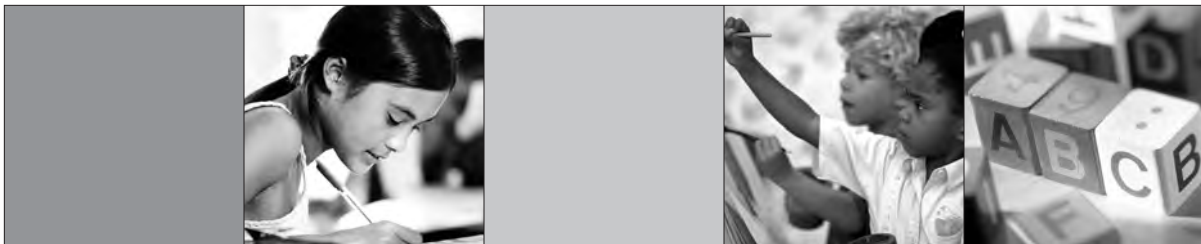


Excerpted from
Multiple Intelligences and Instructional Technology
Second Edition
By Walter McKenzie

Sometimes theory and tool fit together beautifully. Popular author and consultant Walter McKenzie's *Multiple Intelligences and Instructional Technology* made the case so well that we've brought out a Second Edition. Thoughtfully updated throughout, it includes additional lesson plans and materials, new Web sites and online resources, and activities for the latest hardware. This excerpt includes practical approaches to adapting existing lessons for multiple intelligences and learning styles as well as inspiring stories and flexible models for transforming education. Help every child succeed!

CHAPTER 6

Modifying Existing Lessons



One of the appealing features of Gardner's theory is that it confirms so much of the work teachers already do in the classroom. Good teachers have been instinctively catering to different intelligences without even knowing of the MI model. Presenting Gardner's theory to teachers is a pleasure because his work validates so many good things they already do. This makes for a sound marriage of theory and practice, because teachers are immediately ready to take a look at their classroom-tested lessons and units and superimpose them on the MI model. It sounds easy enough, right? But you'd be surprised how working through this process raises as many questions as it answers! To make it easier to move from theory to practice, we will look at a process for modifying existing lessons that I call the POMAT approach: Procedure, Objective, Materials, Assessment, and Technology.

A Rationale for Modifying Existing Lessons

For the last half-century, teachers have come to expect textbook publishers and curriculum marketers to put together prepackaged instructional programs that are a combination of salesmanship, structure, and resources. While many reform movements have bemoaned a situation in which the commercial tail is wagging the educational dog, teachers have, in fact, grown quite accustomed to having a prepackaged program in place that they can borrow from and refer to as needed. It's convenient and it saves time. Moreover, it's familiar after five decades; it's comfortable. Gardner, on the other hand, does not advocate the prepackaging of MI theory. MI theory recognizes the unique nature of each individual learner, and developing lessons based on this theory requires a blend of the teacher's personal instructional style with the particular combination of student MI profiles present in any given class. That's not to say that companies are *not* trying to package and sell an "MI approach" to instruction. If they can sell it, they'll market it! It simply means that this prepackaged approach may not be appropriate for effective instruction.

Having said this up front, I know that teachers interested in incorporating MI theory into their curriculum typically analyze and revise existing lessons or units with good intentions and a certain amount of uncertainty:

- Will I have to revise my objectives?
- How do I decide which intelligences to employ?
- Should I incorporate all the intelligences into a lesson?

The answers are not at all clear-cut or obvious once you start looking at your own work.

First, we should agree on a basic rationale for modifying existing instruction: teachers should edit and revise existing lessons and units with the idea of maximizing the number of intelligences accommodated. This should not be an exercise in documenting the intelligences that your lessons and units already address. To simply categorize existing lessons by the intelligences they accommodate is to spend time you don't have validating lessons you don't intend to change. The only common-sense reason for making modifications based on MI is to take lessons you already know and love and improve them by making additional connections for all your students.

We should also have a working definition of what it means to accommodate, stimulate, or otherwise employ an intelligence in a lesson. Exercising an intelligence by definition means that an activity utilizes that intelligence for the explicit purpose of instruction. For example, the fact that students talk with one another while completing a lab experiment is not proof that they are exercising their verbal intelligence. Talking while working is not in and of itself supportive of the instructional outcome. On the other hand, having students work together to brainstorm possible solutions as part of a creative problem-solving activity contributes to the learning outcome of the lesson. It is by definition an accommodation of the verbal intelligence. Another example is Gardner's humorous anecdote of being welcomed into a kindergarten classroom where he observed children crawling on their hands and knees, yelping and howling. When he asked the teacher about the activity, Gardner was informed that the children were exercising their kinesthetic intelligence. Unimpressed, Gardner responded that this was

not kinesthetic intelligence, but merely a group of children crawling on the floor and howling like wolves! Keep this story in mind as you identify intelligences in existing lessons.

It is important to remember that it is not necessary or even advisable to try to accommodate all the intelligences in any one lesson. Trying to work all nine intelligences into a single lesson usually results in a contrived, chaotic mess, with students unable to benefit from the resulting saturation of inputs and experiences. Instead, you should expect to integrate no more than three to five intelligences into one lesson. The most appropriate intelligences to target will become evident as you work with an existing lesson and should flow naturally from the content of your plan. This is important because children need to see natural, obvious connections between the intelligences if they are going to truly benefit from your efforts. If your lesson tries to force an intrapersonal connection that just doesn't flow with the rest of the lesson, it will throw students off rather than help them understand. In short, if the introduction of a new intelligence into an existing lesson doesn't fit naturally and easily into your plan, omit it. When in doubt, leave it out!

As for the proper design of an MI lesson, start with a clear objective. Continually refer back to that objective to make sure that you are staying on course as you build the rest of the lesson. For an existing lesson, this may mean modifying the original objective slightly to make room for additional outcomes. With a clear objective in place, you can then identify the intelligences you want to include in your lesson. There should be an obvious, natural connection between any intelligence you choose to include and your objective. Finally, use your objective and list of intelligences to determine the technologies (if any) you would like to employ in the lesson. Not every lesson will benefit from the use of technology, and knowing when it is and is not appropriate comes with practice and experience. As you start the process of modifying lessons, your purpose is to help students reach your stated objective by incorporating technologies that stimulate the target intelligences.

The POMAT Method

The rote practice of identifying the objective, intelligences, and technologies for each lesson can quickly devolve into a going-through-the-motions process in which you no longer use a critical eye. From my own experience, I know that after creating a few lessons in this way it's easy to fall into a pattern of using similar-sounding objectives with familiar intelligences and favorite technology applications, lesson after lesson. People are, after all, creatures of habit and it's hard to look at every new lesson with a fresh eye. For this reason, I have developed the POMAT approach (Procedure, Objective, Materials, Assessment, Technology) to modifying existing lessons. The POMAT process breaks up the lesson revision process into five steps that require you to think about how well your lesson maps out.

The POMAT approach is based on the notion of "backward planning," developed by Grant Wiggins and Jay McTighe, from the view of the teacher-practitioner. The teacher first looks at a lesson's procedure, and then maps back through the objective, materials, and assessment to determine a consistency of purpose. If the actual flow of a lesson nicely matches the objective and assessment, the lesson plan is soundly designed and will bring maximum instructional success. If a lesson is inconsistent in any of its critical components, the POMAT process will identify gaps and weaknesses that the teacher can then address. The entire procedure is

designed to examine a lesson's consistency within the context of the nine intelligences. Here are the five steps of POMAT:

- 1 **Procedure.** Without looking at any other part of the existing lesson, go directly to the procedure and make notes on each prescribed activity and the intelligences it accommodates. For example, if students are asked to select a type of bridge from a previous lesson to employ in their design, you could note the naturalist intelligence (the intelligence of categories and hierarchies) on the POMAT chart (see Table 15). If students are then asked to calculate the dimensions of a bridge they are to build, you might note on the POMAT chart that this stimulates the logical intelligence. Complete this process for the entire lesson's procedure, noting any and all intelligences that are accommodated.
- 2 **Objective.** Now go to the beginning of your lesson plan and examine your stated objective. Note on the POMAT chart which intelligences seem to fit this objective. For instance, if the objective states that the learner will construct a bridge 3 feet in length that will allow a 12-pound remote-control truck to cross safely 2 feet off the floor, you may note that it will accommodate the logical and kinesthetic intelligences. Be sure to note only the intelligences the objective clearly accommodates.
- 3 **Materials.** With the procedure and objective reviewed, you can now look at the list of materials you have generated for the lesson. Which intelligences do these materials stimulate? Note on the POMAT chart that the building supplies and hand tools accommodate the logical, visual, and kinesthetic intelligences.
- 4 **Assessment.** Now, look at your assessment plan. Is it consistent with the procedure, objective, and materials in the intelligences it utilizes? Is there a clear agreement between the objective, materials, procedure, and assessment in terms of the intelligences addressed? In the case of the bridge construction lesson, testing the bridge by rolling the 12-pound truck over it is the test of choice. It is practical, verifiable, and an exciting culminating event for the lesson. If your assessment matches well with your objective and the intelligences you have identified throughout the lesson, you're on solid ground!
- 5 **Technology.** Finally, review the POMAT chart you have created and determine which technologies, if any, should be included. Most likely you are already employing certain industrial technologies in the lesson. But what about digital technologies? Is this a good activity for introducing probeware? If you project a spreadsheet on the wall and fill it with the data for each bridge the class has constructed, will that be an appropriate use of technology? Or maybe you could use a digital camera to take pictures of the students at work so that the class can work on a multimedia presentation of the experience. With sufficient planning, you could even invite other classes to participate in an online competition to build a bridge that best meets the lesson objective, and compare results and data. Where this lesson fits in your overall curriculum will determine which uses of technology are most appropriate and effective.

The CD-ROM that accompanies this book contains a blank POMAT template for your use. Table 15 shows the five POMAT steps for a culminating lesson in a unit on bridges.

TABLE 15

The POMAT Chart						
INTELLIGENCES	POMAT					
	<i>Procedure</i>	<i>Objective</i>	<i>Materials</i>	<i>Assessment</i>	<i>Technology</i>	
Verbal						
Logical	✓	✓	✓	✓	✓	
Visual	✓		✓		✓	
Kinesthetic	✓	✓	✓		✓	
Musical						
Intrapersonal				✓		
Interpersonal	✓					
Naturalist	✓			✓		
Existential						
NOTES	Organizing, building, measuring, problem solving, working in groups	Problem solving and building	Hand tools, rulers, balsa wood, nails, screws, safety goggles, information books, paper, pencils	Driving 12-pound remote control truck over bridge; identifying the best bridge designs	Hand tools, rulers, nails, screws, remote control trucks	

Analyzing your existing lessons using the POMAT method will help you quickly identify areas of strength in your lesson. This bridge construction task, for example, is a logical, problem-solving task with visual and kinesthetic implications for the learner. There's a clear interpersonal dimension to the task, and students must organize and categorize as they go. But look where the lesson comes up empty: for all the chatter that will likely fill the room as the students build their bridges, there's no direct link between the stated lesson objective and the verbal intelligence. Also, for all the patterns discernible in the design of bridges, and for as much aesthetic beauty as they can add to the environment, neither the musical or existential intelligences have instructional connections here. Picture a child in your class who is very verbal but has a hard time generating effective solutions to problems, or a student who has strong personal convictions and is preoccupied with the effect of bridges on the surrounding landscape. As creative and hands-on as this lesson is, it misses the opportunity to connect with these students. If you have a significant number of students who are very strong in these intelligences, you might consider modifying the objective and procedures accordingly.

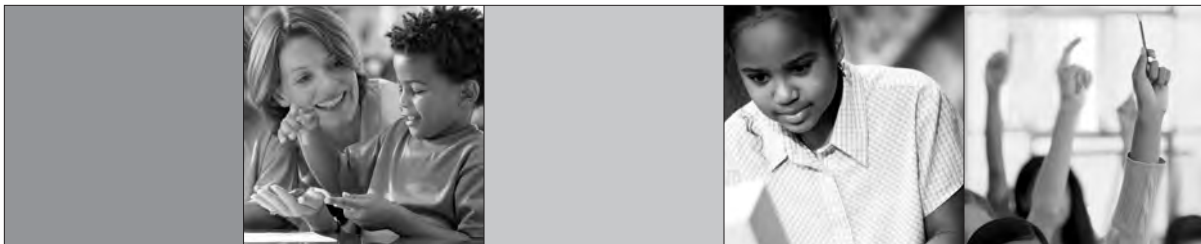
From this summary of the POMAT exercise, which digital application might be the most appropriate to incorporate in this lesson: probeware, a spreadsheet program, presentation software, or an online collaborative project? Probeware is a catch-all term for an array of tools that allow students to record data and see digital representations of their experiments. It clearly has both visual and logical applications, two intelligences that the task already targets. If you wish to bolster the visual component of this lesson, probeware would be a good choice. A spreadsheet program, such as Excel, is great for stimulating the logical and naturalist intelligences and for making connections to the visual intelligence with a graph or chart. If you would like to reinforce the visual, logical, and naturalist intelligences, Excel is clearly a good choice. Multimedia presentation tools such as PowerPoint (particularly when used in combination with a digital camera) make excellent use of the verbal, visual, and interpersonal intelligences. There is a nonlinear component to creating a presentation that allows learners to make their own connections between ideas and see new relationships. Similarly, an online collaborative project can reinforce the logical, visual, and kinesthetic elements of the lesson while adding to its interpersonal and intrapersonal dimensions. Such a project could also be used to bring in the musical and existential intelligences, if that is appropriate for your students. In summary, there's no one right answer—it's up to you to determine the most effective focus for your lesson!

By the time you complete this POMAT process, you will be surprised at how much clearer you can see your choices. No, it's not prepackaged and ready to fly, and there's no one right answer. You have to carefully consider the context for the lesson to determine the answer that's right for you. You can decide:

- not to use digital technologies to keep the lesson finite and circumscribed.
- to add nontechnological tasks to the lesson to stimulate additional intelligences. These might include an oral presentation, a challenge to identify patterns in bridge design, or a discussion of bridge aesthetics and the effect of bridges on the environment.
- to use probeware or Excel to enhance the lesson objective.
- to use PowerPoint to extend the lesson without changing its primary focus.
- to choose an online collaborative project and develop a unit that will take the lesson in a completely new direction that opens it up to a variety of intelligences.

CHAPTER 8

Becoming a Technoconstructivist



When integrating MI theory into instruction, the human variable is perhaps the most important to keep in mind. Many new approaches to instruction have come down the road with great fanfare, only to pass by and disappear over the horizon without causing much of a stir. Ask a veteran teacher what he or she thinks about the latest and greatest innovation in education, and that teacher will likely tell you of similar approaches that were touted and then discarded 15 or 20 years ago. There is rarely anything new under the sun.

So, when something reinvents the fundamental structure of society the way digital technology does, people sit up and take notice. Even if some educators are not thrilled with the idea of having to master these complicated new technologies, they cannot ignore the money being spent on hardware, software, and training—not to mention community expectations—to do just that. In certain states, teacher certification is already being linked to technology proficiency. Reality has hit home as educators choose to either update their training or leave the profession.

Transforming Education

When a new innovation is assimilated into an institution such as public education, it takes on many forces already in place. There are educational reform movements requiring teachers to document and improve the quality of the education children receive. There are pressures from special interest groups that want to emphasize literacy, science, math, social studies, or other areas of the curriculum. Teachers are also preoccupied with doing all they can to promote student success on state standardized achievement tests.

Meanwhile, the educational dollar can stretch only so far. Consequently, priorities are chosen and technology takes its place based on the values and attitudes of local administrators. If you're working in a district where technology is a major emphasis, technology becomes an imperative for all teachers. If you're working in a district where basic skills and core curriculum values are prioritized, technology may not be high on your list of professional priorities.

For the majority of educators who work in a district that has not adopted either extreme, student technology use is determined in individual classrooms, based on the accessibility of technology, the availability of training, and the value a teacher places on technology as an instructional tool. The typical teacher wants to incorporate technology as he or she sees fit. This limits student use of technology to applications that are familiar to that particular teacher.

For example, six fourth-grade classes at school A may be studying the solar system at the same time. Three of the six may have their students creating three-dimensional working models of the relationships among the sun, earth, and moon. One of these three teachers actually bookmarks a short list of excellent Web sites for student research, including a NASA Ask-an-Expert site, sites with pictures taken in space and transmitted to earth, and several sites that use current Web technologies to present interactive animations of the solar system and its phenomena. While the other two teachers are using Styrofoam and papier-mâché to create their models, our technology-connected teacher is asking students to create digital multimedia presentations that will demonstrate working models of the sun, earth, and moon while offering links to vocabulary and external links to Web resources on the subject. These students have expressed interest in creating interactive quizzes at the end of their presentations, and the teacher has already contacted the school Webmaster about posting these finished products on the school site to share with the larger community. Only a small number of children from this entire fourth grade will have the opportunity to study the solar system using digital technology, because only one of the six teachers has made it a priority in her instruction.

Technology not only helps students travel across space, but through time as well. Consider how Faithe Ferrante uses a virtual field trip to immerse students in World War II Europe, shown in Table 24.

TABLE 24

A Virtual Field Trip to WWII Europe Unit

UNIT TITLE:	A Virtual Field Trip to WWII Europe		
TEACHER:	Faithe Ferrante, Long Beach Middle School, Long Beach, New York		
GRADE LEVEL:	8		
SUBJECT(S):	English, Social Studies	TIME FRAME:	5 class periods (42 minutes each) in the computer lab

GOALS	INTELLIGENCES	TECHNOLOGIES	STANDARDS
This assignment allows students to connect to the Holocaust by looking at pictures and reading personal accounts of the events. In this unit, the students visit two locations on virtual field trips: the Anne Frank House (where she hid during the war) and the Auschwitz concentration camp.	Verbal Intrapersonal Existential Visual Interpersonal Naturalist	Computers Internet Microsoft Word Microsoft Powerpoint Browser	NETS for Students: 2. Social, ethical, and human issues <ul style="list-style-type: none"> Students understand the ethical, cultural, and societal issues related to technology. Students practice responsible use of technology systems, information, and software. Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity. 5. Technology research tools <ul style="list-style-type: none"> Students use technology to locate, evaluate, and collect information from a variety of sources. Students evaluate and select new information resources and technological innovations based on the appropriateness to specific tasks.

(Continued)

A Virtual Field Trip to WWII Europe Unit

(Continued)

MATERIALS	INTELLIGENCES
<p>Anne Frank House and Related Web Sites www.ushmm.org/museum/exhibit/online/hidkid/index/ www.annefrank.com www.library.yale.edu/testimonies www.remember.org</p> <p>Auschwitz and Related Web Sites http://holocaust-history.org www.holocaustsurvivors.org www.auschwitz-muzeum.oswiecim.pl/html/eng/start/index.php www.wiesenthal.com</p>	<p>Intrapersonal Visual Existential Verbal</p> <p>Intrapersonal Visual Existential Verbal</p>
PROCEDURE	
<p>Preparation The teacher will have provided students with general background information about World War II concentration camps and Anne Frank's life prior to this assignment. The teacher will distribute the assignment during the preparation period and go over it with the class.</p> <p>Activities Students will visit Web sites depicting the secret annex and view pictures of Anne Frank and the other annex members. These experiences will help them better understand Anne's diary. They will also take a virtual field trip to Auschwitz and conduct research on concentration camps.</p> <p>Anne Frank House Activity While students are visiting the secret annex, have them spend time in the room that Anne shared with Mr. Dussel and answer the following questions: What does the room look like? Does it resemble the room of a typical teenager? Why? Why not? What does the room reveal about Anne's personality? Have students collect one picture artifact from an Anne Frank Web site.</p> <p>Auschwitz Activity Auschwitz was a concentration camp where many victims of the Holocaust wrongfully lost their lives. Have students look at the photo gallery and write a reaction in which they answer the following questions: What would you say to the many people who died at Auschwitz if you had the chance? What have you learned about pain and suffering through their unfortunate experiences? Have students collect three picture artifacts from Auschwitz Web sites.</p>	<p>Verbal Interpersonal</p> <p>Visual Verbal Intrapersonal Existential</p> <p>Visual Intrapersonal Existential</p> <p>Visual Verbal Intrapersonal Existential</p>
PRODUCT	
<p>Anne Frank House Poster Have students create a digital poster about Anne's experiences in hiding. Students should include pictures and family items, as well as other things that were important to her. They should also include pictures of the secret annex and explanations of what her life was like while she was hiding during the war. Have students include five quotes and citations from Anne's diary on the poster.</p>	<p>Visual Verbal Intrapersonal Existential</p>

(Continued)

A Virtual Field Trip to WWII Europe Unit

(Continued)

PRODUCT	INTELLIGENCES
<p>Auschwitz Journal Ask students to pretend they are Jewish prisoners in Auschwitz during World War II. Have them write five journal entries describing their experiences there. Direct students to use the information they learned during the virtual field trip to create realistic entries.</p> <p>PowerPoint Presentation Students will show their field trip artifacts to the class in a 3–5 minute oral PowerPoint presentation. During the presentation, students will share their understanding of life in World War II Europe.</p>	<p>Verbal Intrapersonal Existential</p> <p>Visual Verbal Intrapersonal Existential</p>
<p>ASSESSMENT</p> <p>Students will be asked to organize each product created during the unit in a unit portfolio. Students will be graded using a rubric.</p>	<p>Visual Verbal Intrapersonal Existential</p>

Faithé has made a conscious choice about instruction: rather than simply imparting knowledge and training her students to respond correctly when she prompts them for a “right answer,” Faithé strives to provide learning experiences that immerse her students in information-rich experiences. During this virtual field trip, her students have the opportunity not only to internalize information about the Holocaust, but to develop their own opinions and ideas based on this experience. As a result, she helps her students develop a much higher mastery of this significant historical event, with a greater ability to demonstrate that understanding on any of a number of assessment tasks.

The key, then, is to choose activities and approaches that encourage critical thinking in students. Force-feeding students with “right answers” may take less time, but does it truly develop mastery? What if the assessment task doesn’t test your students in the same way that you’ve trained them? Are you really teaching them to think, or conditioning them to respond? Many teachers are so sensitive to current trends in accountability and the documentation of student learning that they shy away from using technology to promote critical thinking. “How can we possibly spend a lot of time on computer applications,” they wonder, “when there is so much content to cover for state tests that we’ll be lucky if these kids are ready in time?” Others who are required to make time for computers in instruction still resist, saying, “All of these higher level applications are fine and dandy, but they aren’t going to help my kids fill in the bubbles correctly on standardized tests. What they need is more drill on skills!”

These pressures are very real. In some areas, teachers are actually in danger of losing their jobs if a certain percentage of students do not pass these tests every spring. Each one of us needs to do some soul-searching. Do we sincerely believe that the most effective way to prepare children for standardized tests is to offer instruction that panders to lower levels of thinking?

Jamie's Story

Consider Jamie, a young man I taught in fourth grade just as the Virginia Standards of Learning (SOL) tests were being rolled out statewide. Jamie was functioning below grade level in language arts and mathematics, and he received daily instruction from a specialist in both areas to supplement his regular classwork. Coming from a disadvantaged home, Jamie did not have a lot of the material things other students owned, and even though he lived less than an hour from our nation's capital, he had not been exposed to any of its cultural riches. Jamie's cumulative record sounded all too familiar to this veteran teacher of 14 years. His standardized test scores were extremely low, and his annual report card grades were consistently poor from year to year. Jamie also had regular discipline problems with peers and teachers, as he did not like school.

This was the first year that Virginia schools were expected to have at least 70% of their students pass a state SOL test on Virginia history. All five of us teaching fourth grade in my school felt under the gun to do everything we could to cover 400 years of Virginia history, including economics, government, and current events. As we met to plan at the beginning of the year, three of the teachers were sure that they wanted to focus on social studies: names, dates, places, and map skills, using as many textbooks, worksheets, homework assignments, and quizzes as they could muster. While this was a strongly traditional way to go, I wasn't convinced that our students would be able to master anything more than rote memorization by testing time in May. I knew there had to be other ways to make this mountain of information meaningful for students. A teammate joined me in searching for something just as comprehensive but more supportive of students with different intelligence profiles. We came up with a cache of instructional approaches for the year that the two of us planned to work on together.

That year my students built a wigwam, researched colonial crafts, organized a "colonial day," performed a musical play in the tradition of 1776, participated in the construction of a Web site on the achievements of Thomas Jefferson, drilled with mop handles over their shoulders in the April mud while singing Civil War songs, used the local newspaper in weekly activities to learn about government and current events, and competed weekly against our rival class in the SOL Olympics (we fondly referred to it as the "SOLympics"), challenging one another in the mastery of Virginia history.

When May rolled around, all five classes took the Virginia SOL Social Studies test. None of the fourth-grade teachers knew how well our kids would test that first year. We all showed deference to one another's methods and supported each other as we waited for the test results to come back. There was a lot of soul-searching on my part during the weeks we waited for the results. What if the drill-and-practice approach worked more successfully? Even worse, what if our highly visible efforts to use more learner-centered approaches to instruction failed and everyone knew it? But it was too late to turn back. The testing was done, the work was turned in, and the chips would fall where they may.

When the test scores came back, the results were riveting. My teammate and I had the only two classes out of the five in which at least 70% of the students passed the test. Granted, both classes scored in the low 70s, but we had gotten over the bar set by the state. This was wonderful validation of our intuition that there had to be a better way to cover such a huge volume of material successfully.

As I looked more closely at each of my student's scores, I was glad to see that almost everyone scored relatively close to my expectations. Even those who didn't pass the test did well enough that I knew they had grown a lot during the year. The evidence clearly indicated that all students gave their very best effort.

Then I came to Jamie's score sheet. I was astounded. Here was a young man struggling to meet the minimum requirements for promotion at each grade level, and he had scored in the 99th percentile on the test! I went over the way the scores broke down for him, and time and time again he had been able to determine the correct answer for each test item. He had outscored every other student in my class!

I thought about this in amazement. How could someone who struggles with reading comprehension do so well on a standardized test? As I looked back over the year, I remembered Jamie's participation in all our Virginia-themed activities. Verbally, he was always able to master the material, and he was quite the ham during our production of a colonial-era play and our weekly SOLympics competitions. He also loved the Civil War drilling, the singing, the class wigwam, and the study of Jefferson.

I spoke with his Chapter 1 teacher to get her take on his success, and she informed me that she was not at all surprised because Jamie had truly blossomed as a reader that year in her room. She had been working with him since kindergarten, and she was amazed at how his attitude toward school and reading had changed. As I put together the big picture of Jamie's year, my amazement subsided and I began to feel humbled by his momentous achievements.

I will never forget the lessons I learned that year. Yes, I had always subscribed to developmentally appropriate practice and multimodal learning. I had always talked a good game and wanted to implement as much of it as I could. But there was always a shadow of doubt in my mind, placed there by colleagues who did not subscribe to such child-centered practices. For me, Jamie's accomplishments were all the validation I needed. I knew now that everything that made sense to me about teaching and learning actually did work. Despite the strong incentives to "drill and kill," the student-centered approaches that we had chosen had won out.

I believe all teachers would be willing to let go of their skills checklists and worksheets if they didn't feel so accountable to state standards. After all, most of us didn't get into teaching for the money. We got into teaching to see that spark in children when they get excited about new learning. That's what it's all about.

A Four-Tier Model

Technology, however, is a different story. Many teachers entered the profession long before the microcomputer appeared in schools. Technology has been thrust upon them as one more requirement they never agreed to when they first entered the classroom. How do teachers respond to the challenge of integrating technology into their existing instructional practices? Scott Noon of Classroom Connect examined this question and came up with a four-tier model of teacher training in technology. Each tier of the model demonstrates an identifiable stage in teacher technology proficiency. The model reflects the way that teachers learn to use technology and the journey they make in the process. Let's take a look at Noon's model (Table 25).

TABLE 25

Noon's Four-Tier Model of Technological Proficiency for Teachers

STAGE	DESCRIPTION	EXAMPLES
Preliterate	Not yet using technology for personal or instructional purposes	Traditional media and materials
Technocrat	Experimenting with technology but unsure of its overall dependability and usefulness	Demonstration station with LCD projector, computer lab, learning station with computer
Technotraditionalist	Using technology proficiently to accomplish traditional classroom tasks	Word processed lesson plans, electronic grade book, e-mail, digital slideshows
Technoconstructivist	Using technology to completely change approaches to teaching and learning in the classroom	Online projects, virtual field trips, WebQuests, digital portfolios, virtual classrooms

The Preliterate User

This is where we all begin. We are aware of technology's presence in our buildings, even in our classrooms, but we do not have the training, experience, or confidence to use the technology. Teachers who fit in this category have yet to establish an e-mail account, use a word processor, or even find a piece of appropriate software that can be used with students to enrich instruction. Perhaps technology seems like another entire body of knowledge that there just isn't time to master. Or perhaps technology seems like a lot of fluff that gets in the way of honest, on-task instructional time.

For each teacher the reasons may vary, but the overwhelming response I hear from educator groups no matter where I go is, "We just haven't had the training we need to make good use of all the hardware and software that's been purchased for us to use." Educational institutions in general are very quick to throw money at a new issue or innovation, and then very quick to move on to other trendy ideas without giving invested initiatives time to fully realize their potential. Many teachers are telling us that this is happening with technology: they don't have the training time or funds needed to complete the technology puzzle. Few teachers are preliterate users by choice; no one wants to be left behind. And since we all start at this point, perhaps that is the impetus that compels us to move forward and become more proficient with technology. Still, how do we move on without the prerequisite training?

The Technocrat

This second tier of Noon's model is a critical point in teacher technology training. Teachers in this category have ventured out to learn how to use an LCD projector connected to a demonstration computer station. They have made the effort to identify instructional applications that

students can successfully use in the computer lab. At the high end of this tier, teachers even dabble in new, more advanced applications to invigorate themselves.

The main characteristic of this category, however, is preoccupation with the technical aspects of technology. How do I turn it on? What do I do if the bulb burns out while I'm presenting to my entire class? What if the server is down and I have 25 children unable to complete the online task I had planned? Of course, the only way to answer these questions is to learn from experience. Technology always offers the possibility of glitches and unforeseen mishaps. High-end users understand this and have learned the tricks of the trade, which include having a Plan B handy whenever technology is going to be used.

By giving teachers the time and support they need to grow as technocrats, we are creating an instructional environment in which technology really gets used because teachers are no longer afraid of it. I believe once teachers can see past their initial fears, they will come to recognize how technology can enrich their lives both personally and professionally.

The Technotraditionalist

For teachers in the third tier of Noor's model, technology is seen as an inherently good thing in instruction, which can be used in a variety of ways around the classroom. Teachers at this level often create word processing templates so they can write their lesson plans in an easy-to-use format. Likewise, technotraditionalist teachers use spreadsheets to create seating charts and electronic grade books. The teachers at this level are high-end users, and they make use of technology to complete the same tasks they have traditionally always accomplished as teachers. Is there anything wrong with that? No! It is an important stage in the development of the technology-savvy teacher. Still, if we are using technology only to keep track of lunch counts and type reports to hang on the wall, how far have we really come? Yes it's more efficient to set up a database to make student mailing labels that you can use all year, but you're still holding on to traditional attitudes about instruction.

If technology is going to be a true agent for change in education (and this remains to be seen), educators at all levels are going to have to be willing to ask themselves fundamental questions about why they continue to do things as they always have. Perhaps some of our preconceptions have to do with growing up in the Industrial Age, when many Digital Age possibilities were not yet available. If technology is to offer any hope for solving traditional problems, then we may have to rethink our assumptions and be willing to go beyond traditionalist uses of technology.

The Technoconstructivist

The technoconstructivist is the highest tier in Noor's model. Here, teachers not only integrate technology into traditional views of instruction, but are willing to reshape those views and explore wholly new learning models made possible by technology. For technoconstructivists, technology is not just an instructional tool, it is a way to transform the classroom into a new and vital learning environment for students.

The technoconstructivist classroom makes use of Web resources, electronic mail, online collaborative projects, synchronous Web-based events, virtual field trips, WebQuests, multimedia presentations, virtual classrooms, interactive simulations, and much, much more. As the Internet breaks down the four physical walls of the classroom as well as the traditional

boundaries of time, space, and money, students are able to use higher levels of thinking, apply real-world approaches and solutions, and collaborate with experts and other learners from around the world. The result is a learning revolution, in which the teacher becomes a facilitator and guide to all the learning possibilities in the world around us, virtual and otherwise. The technoconstructivist is the highest level of technological proficiency for teachers, and one we must all aspire to if we are to realize educational technology's full potential.

If we believe that technology is just another tool for instruction, then it is worth no more than any other piece of equipment in our classrooms. When we are willing to let go of our preconceived notions and traditional ideas, however, we can see technology's true potential to transform instruction. As long as we force technology into the Industrial Age model of education, we are limiting its promise. That is why we have not yet seen much research evidence to support the role of technology in instruction. We need to allow technology to transform our classrooms for the Information Age. It cannot do so if it is just superimposed upon a model of teaching that faded with the end of the last century.

Now consider MI theory in light of Noon's model. How does a teacher use MI with technology in any of the first three tiers? One can argue, perhaps, that teachers at the technotraditionalist level are capable of at least accommodating several intelligences at once, maybe without even realizing it. My question is: "Is this what we really want for good instruction: chancing on effective strategies without even realizing we have done so?" No, good instruction has always been the product of reflective practitioners articulating and meeting their objectives. Why settle for a hit-and-miss model of learning when Gardner and Noon give us such practical, empirical models to use? To integrate multiple intelligences theory and technology into instruction, one must aspire to become a technoconstructivist. Only at this level can teachers truly realize the full potential of every student in their charge.

Consider how Dana transformed her seventh-graders' study of the nervous system into a celebration of learning through different technologies. Figure 8 shows her preliminary flow-chart. Table 26 shows the resulting unit plan.

FIGURE 8
Unit Plan Flowchart Example

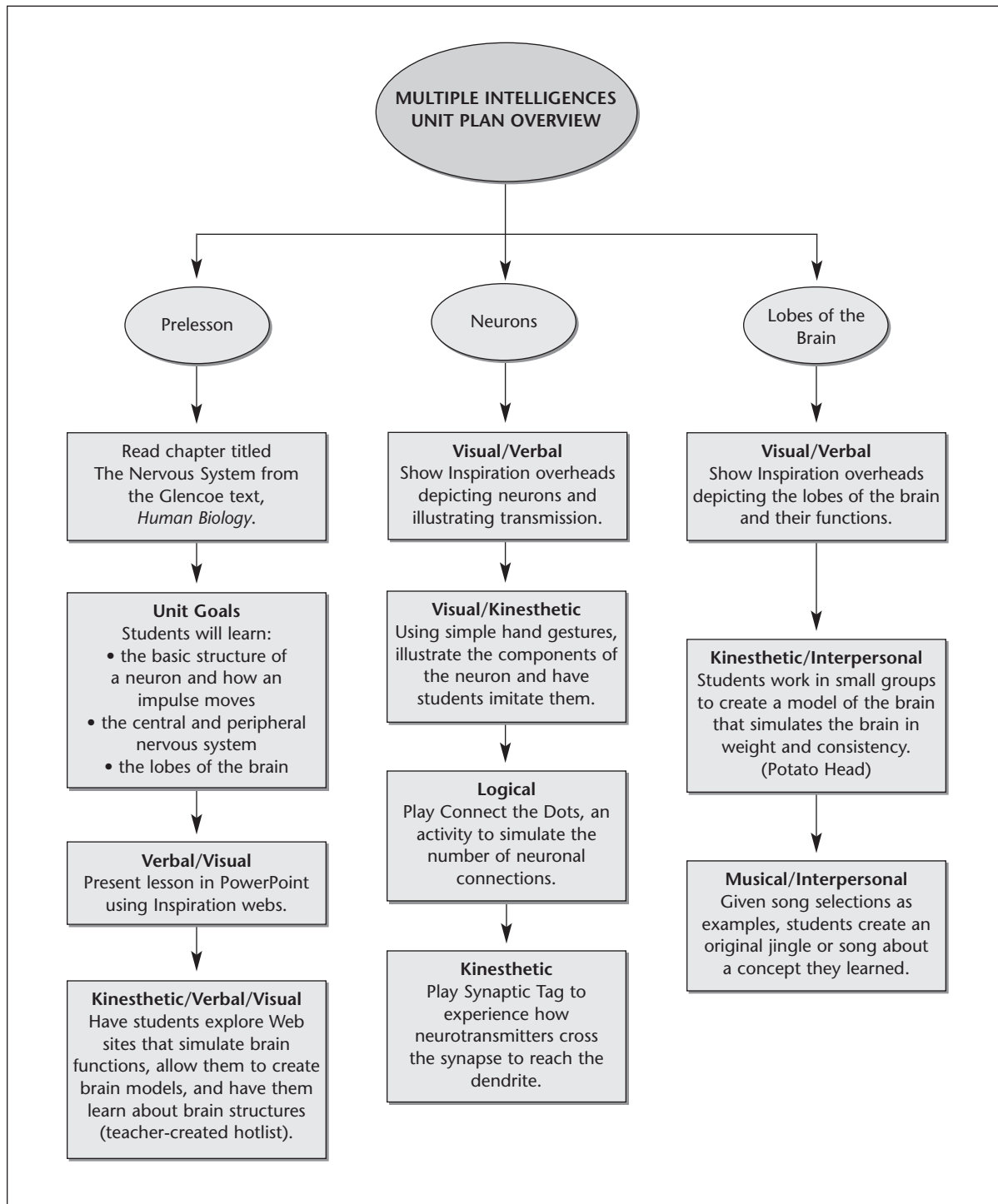


TABLE 26

Our Brain—The 3-Pound Wonder Unit

UNIT TITLE: Our Brain—The 3-Pound Wonder
TEACHER: Dana Topham, Ascension Day School, Lafayette, Louisiana
GRADE LEVEL: 7–8
SUBJECT(S): Science **TIME FRAME:** 3 weeks

GOALS	INTELLIGENCES	TECHNOLOGIES	STANDARDS
<ul style="list-style-type: none"> To learn the basic anatomy of the brain, including the cerebrum, cerebellum, and brain stem; the left and right hemispheres; and the lobes of the brain. To explore the structure and function of neurons. 	Verbal Logical Visual Kinesthetic Naturalist Logical Naturalist	PowerPoint Inspiration Browser	NETS for Students: 3. Technology productivity tools <ul style="list-style-type: none"> Students use productivity tools to collaborate in constructing technology-enhanced models, preparing publications, and producing other creative works.
MATERIALS			INTELLIGENCES
Overhead			Visual
Computer			Kinesthetic
PowerPoint			Verbal Visual
Inspiration			Verbal Visual Naturalist
Web browser			Verbal Visual
Textbook: <i>Human Biology</i> , chapter titled The Nervous System (Glencoe, 1999)			Verbal Visual
PROCEDURE			
Preparation Have students read the Glencoe science chapter The Nervous System. Present a PowerPoint slideshow highlighting key facts of the brain's structure.			Visual Verbal
Have students explore hands-on Web sites through a teacher-created hotlist (www.kn.pacbell.com/wired/fil/pages/listthebraid.html).			Visual Verbal Kinesthetic

(Continued)

Our Brain—The 3-Pound Wonder Unit

(Continued)

PROCEDURE	INTELLIGENCES
<p>Activities</p> <p>Present overheads depicting neurons and illustrating transmission for review of concepts.</p> <p>Use simple hand gestures to illustrate the components of the neuron. Have students follow these instructions:</p> <p>“Hold out your arm and spread your fingers. Your hand represents the ‘cell body’ (also called the ‘soma’); your fingers represent ‘dendrites’ bringing information to the cell body; your arm represents the ‘axon’ taking information away from the cell body.”</p> <p style="text-align: center;">(From <i>Neuroscience for Kids, Modeling the Nervous System, Simple Neuron Model</i>, http://faculty.washington.edu/chudler/chmodel.html)</p> <p>Conduct “Connect the Dots,” an activity to simulate the number of neuronal connections:</p> <p>“This exercise is to illustrate the complexity of the connections of the brain. Draw 10 dots on one side of a piece of paper and 10 dots on the other side of the paper. Assume these dots represent neurons, and assume that each neuron makes connections with the 10 dots on the other side of the paper. Then connect each dot on one side with the 10 dots on the other side. Remember that this is quite a simplification. Each neuron (dot) may actually make thousands of connections with other neurons. If you tried this your paper would be really messy!”</p> <p style="text-align: center;">(From <i>Neuroscience for Kids, Modeling the Nervous System, Connect the Dots</i>, http://faculty.washington.edu/chudler/chmodel.html)</p> <p>Use the outside game “Synaptic Tag” to follow up on the concept of how neurotransmitters cross the synapse to reach the dendrite:</p> <p>“In the game of Synaptic Tag, you are part of the synapse. The object of the game is to get as many neurotransmitters across the synapse to the dendrite without being caught (deactivated) by the enzyme. It is like a game of tag. Draw or find a space for the axon and a dendrite (see the picture below). Some players are neurotransmitters and they wait in the axon; other players are enzymes and they wait in the gap between the axon and the dendrite. It is best to have more neurotransmitters than enzymes. The enzymes are ‘it.’ ”</p> <div data-bbox="457 1341 881 1604" data-label="Image"> <p>The diagram illustrates a synapse. On the left, a curved line represents the axon, with several small circles labeled 'Neurotransmitters' inside it. On the right, a larger curved line represents the dendrite. Between the axon and the dendrite is a gap labeled 'Enzymes'. Arrows indicate the movement of neurotransmitters from the axon towards the dendrite across the synaptic gap.</p> </div> <p>“When someone says ‘go,’ the neurotransmitters run across the synapse as fast as possible without being touched by an enzyme. If a neurotransmitter is touched by an enzyme, it must go back (be reabsorbed) into the axon and wait until the next turn. If a player makes it to the dendrite, the player is safe. Play as many times as you like. Make sure everyone has a chance to be a neurotransmitter and an enzyme.”</p> <p style="text-align: center;">(From <i>Neuroscience for Kids, Outside Games, Synaptic Tag</i>, http://faculty.washington.edu/chudler/outside.html)</p>	<p>Visual Verbal</p> <p>Kinesthetic</p> <p>Logical</p> <p>Kinesthetic</p>

(Continued)

Our Brain—The 3-Pound Wonder Unit

(Continued)

PROCEDURE	INTELLIGENCES
<p>Present overheads depicting lobes of the brain for review of concepts.</p> <p>Have students work in small groups to create a model of the brain that simulates the brain in weight and consistency. Conduct the “Potato Head” activity:</p> <p>“This activity is meant to simulate the actual weight and size of a human brain.</p> <ul style="list-style-type: none"> • 5 cups instant potato flakes • 2.5 cups hot water • 2 cups sand <p>Combine all ingredients in a Ziploc bag and mix. It should weigh about 3 pounds and simulate the texture of a human brain.”</p> <p>(From <i>Neuroscience for Kids, Modeling the Nervous System, Model a Brain</i>, http://faculty.washington.edu/chudler/chmodel.html)</p> <p>Given song selections as examples, the students will create a new song or jingle about a concept they have learned.</p> <p>(From <i>Journey Into the Brain, Brainy Tunes</i>, www.morphonix.com/software/education/science/brain/game/songs/brainy_tunes.html)</p> <p>Follow-Up</p> <p>Create a “brain” display and invite younger students to view the projects created. Pair students and allow them to “teach” the concepts to the younger students. The display should include student-created material, opportunities for exploring brain models, and other interactive materials.</p>	<p>Visual Verbal</p> <p>Kinesthetic Interpersonal</p> <p>Verbal Musical</p>
PRODUCT	
<p>Working in pairs, the students will complete at least two projects:</p> <ul style="list-style-type: none"> • Create a model of the brain using any selected medium (clay, Play-Doh, papier-mâché). The brain should be constructed according to scale and clearly depict the four lobes of the brain. Create a model of a neuron. It should include the axon, dendrites, and cell body. • Make of recording of at least five brain songs (original or ones reviewed in class). • Create three illustrations of the brain: (1) show the four lobes of the brain, (2) show the left and right hemispheres, (3) show the cerebrum, cerebellum, and brain stem. • Using simplified terminology, create a simple diagram of the lobes of the brain and their function, to be presented to a class of third-grade students. Be prepared to be the teacher and teach your minilesson 	<p>Kinesthetic Logical Naturalist</p> <p>Musical</p> <p>Visual Naturalist</p> <p>Visual Interpersonal Naturalist</p>
ASSESSMENT	
<p>Students will be evaluated on the two projects they complete:</p> <ul style="list-style-type: none"> • Brain Model • Brain Songs • Brain Illustrations • Brain Lobes Diagram 	<p>Kinesthetic Logical Naturalist Musical Visual Interpersonal</p>

Dana is clearly a blossoming technoconstructivist. Her varied classroom activities and use of technology to accomplish deeper student understanding speak well of her determination to make everyday learning a memorable event in her classroom.

How do we know when we have finally arrived as a technoconstructivist? It's a subjective judgment to some degree. I would argue that we never truly arrive; we simply keep working to evolve our instructional practices to more closely approximate the ideal. In short, I continue to aspire to be a technoconstructivist.

Traditional instructivist teaching takes less time than constructivist approaches. In this era of strict state standards and high-stakes testing, in which schools and teachers are held accountable for their students' performance on standardized tests, this seems like a tempting trade-off. Developing critical thinkers who take risks to solve problems in an environment where there isn't one right answer is a messy business. It's open-ended and time-consuming. Still, aren't all humans constructivist by nature? Don't we all discover meaning based on our own life experiences? Ultimately, each of us has to decide the business we are in: the business of test scores or the business of lifelong learning. What is your motivation as an educator? For me, it's seeing that spark light up in a struggling student's eyes, as it did for Jamie. Meaningful, engaging instruction creates motivated, lifelong learners—that is the true promise of technoconstructivism.

Resources for Further Study

Print

Carroll, J. A., Kelly, M. G., & Witherspoon, T. L. (2003). *NETS•S curriculum series: Multidisciplinary units for prekindergarten through grade 2*. Eugene, OR: International Society for Technology in Education.

Hannah, L. (Ed.). (2002). *NETS•S curriculum series: Multidisciplinary units for grades 3–5*. Eugene, OR: International Society for Technology in Education.

McKenzie, W., Archibald, D., Hutchison, M., Manweller, M., Moersch, C., Terry, P., & Jones Woods, C. (2004). *NETS•S curriculum series: Social studies units for grades 9–12*. Eugene, OR: International Society for Technology in Education.

O'Hara, S., & McMahon, M. (2003). *NETS•S curriculum series: Multidisciplinary units for grades 6–8*. Eugene, OR: International Society for Technology in Education.

Palloff, R. M., & Pratt, K. (2003). *The virtual student: A profile and guide to working with online learners*. Hoboken, NJ: Jossey-Bass.

Waterhouse, S. (2004). *The power of eLearning: The essential guide for teaching in the Digital Age*. Upper Saddle River, NJ: Allyn & Bacon.

Wenger, E., McDermott, R., & Snyder, W. M. (2002). *Cultivating communities of practice*. Cambridge, MA: Harvard Business School Press.

Online

Are You a Techno-Constructivist?:

www.educationworld.com/a_tech/tech/tech005.shtml

Constructivism: From Philosophy to Practice:

www.cdli.ca/~elmurphy/emurphy/cle.html

Creating a New Culture of Teaching and Learning:

www.anovember.com/articles/asilomar.html

Critical Friends Groups: Teachers Helping Teachers to Improve Student Learning:

www.pdkintl.org/edres/resbul28.htm

Drill the Teachers, Educate the Kids:

www.anovember.com/articles/drill.html

How Friends Can Be Critical as Schools Make Essential Changes:

http://ces.edgateway.net/cs/resources/view/ces_res/43

School Reform: What Role Can Technology Play in a Constructivist Setting?:

<http://pixel.cs.vt.edu/edu/fis/techcons.html>

Reflections

- 1 Where would you place yourself in Noon's model of teacher technology use?
- 2 How can a technotraditionalist accommodate the intelligences through technology? What limits or assists this?
- 3 Can you still keep your lessons compact and manageable as a technoconstructivist? Defend your answer.
- 4 What kind of support do you need to become a technoconstructivist?

Sure to be a big hit with multidisciplinary teams and educators working with special needs, ISTE's new *Multiple Intelligences and Instructional Technology, Second Edition* also belongs on every curriculum developer's and teacher educator's bookshelf. Order now by phone, fax, or online. Single copy price \$43.95. ISTE member price \$39.55. Special bulk pricing available. Call 1.800.336.5191 or go to www.iste.org/bookstore/.