1 Differentiated Instruction

Then and Now

DIFFERENTIATED INSTRUCTION: THE FIRST DECADE

Both general education teachers and special education teachers are generally familiar with the concept of differentiated instruction because of the highly diverse learning characteristics displayed by the students in general education classrooms today (Bender, 2008; Bender & Waller, 2011b). Since Tomlinson wrote the initial book on differentiated instruction in 1999, teachers across the nation have begun to implement a wider variety of activities in their classes, based on the differentiated instructional paradigm (O'Meara, 2010; Sousa & Tomlinson, 2011; Tomlinson, 2010). While any group of students is likely to demonstrate considerable variation in their learning characteristics, the learning characteristics that are displayed by many kids with learning disabilities and/or other learning disorders within the general education classroom are likely to further necessitate a variety of learning activities in most general education classes.

As every veteran teacher realizes, students with learning disabilities and other learning disorders may be less engaged in the learning task, unable to cope with multiple instructions, and poorly organized in their thinking and work habits when compared with students without disabilities. Approximately 75 percent of students with learning disabilities are males, and because males are more physically active than females at many age levels (Bender, 2008; King & Gurian, 2006), the mere volume of physical activity shown by males with learning disabilities in the typical classroom can enhance the difficulties these students have. When these deficits are coupled with severe academic deficits, the result can be very challenging for general education and special education teachers alike. Thus, these teachers are hungry for tactics and ideas that work for these challenging students. The differentiated instructional approach, while appropriate for virtually all general education classes, is particularly helpful to students with this array of learning challenges (Bender, 2008).

Origins of Differentiated Instruction

> Differentiated instruction is best conceptualized as a teacher's response to the diverse learning needs of students.

The concept of differentiated instruction was originally based on the need for teachers to differentiate instruction to meet the needs of diverse learners in the general education class (Chapman & King, 2005; 2003; O'Meara, 2010; Tomlinson, 1999; 2003). This includes students with learning disabilities as well as a number of other mild and moderate disabilities, since students with mild and moderate disabilities are quite likely to be included in general education classes. Differentiated instruction was and is best conceptualized as a teacher's response to the diverse learning needs of students in the general education classes (Tomlinson, 2010; 1999; Tomlinson & McTighe, 2006).

Teachers must know the learners in the class, understanding not only such things about each learner as her learning abilities, her academic levels, and her individual learning styles and learning preferences but must also show a concern for each student by tailoring instruction to meet her unique needs. In creating the concept of differentiation, Tomlinson (1999) incorporated a wide range of recent research on how diverse students learn. The concept was primarily founded on Dr. Howard Gardner's concept of multiple intelligences, coupled with the more recent instructional suggestions emerging from the brain-compatible research literature (Gardner, 2006; Goleman. 2006; Moran, Kornhaber, & Gardner, 2006: Sousa & Tomlinson, 2011; Tomlinson, 1999). With this emphasis on diverse learning styles as a backdrop, Tomlinson encouraged teachers to personalize the instructional activities in order to challenge students with a highly interactive, challenging, and interesting curriculum. Teachers were encouraged to consider students' unique learning styles and then differentiate the educational activities presented in the class to provide for those divergent learning styles.

In particular, Tomlinson encouraged differentiation in three areas:

1. *Content* (what is learned)
2. *Process* (how the content is mastered by the student)
3. *Product* (how the learning is observed and evaluated)

The learning content involves what students are to master and what we want the students to accomplish after instruction (Tomlinson, 1999; Tomlinson, 2010). The academic content that students are expected to master is today delineated in state-approved curricula or (for many states) within the Common Core State Standards (www.commoncorestandards/thestandards). Thus, the content, in many ways, is a "given" in education today and typically cannot be varied a great deal by the teacher. However, the presentation of that content can be varied, and teachers might choose to present content in a variety of forms including modeling the content, rehearsal, choral chanting, movement associated with the content, educational games, or student-developed projects associated with the content. Of course, these variations should be established with specific learners and their needs in mind, and all have been discussed in the literature on differentiation (Bender, 2008; Chapman & King, 2003; 2005; Gregory, 2008).

Differentiated instruction also emphasized the learning process that students must complete in learning the content (Tomlinson, 1999). Of course, different students learn in different ways—some through movement associated with the content, and others through visual aids or graphic organizers, while others learn via outlining (Bender, 2008; 2009a; Sousa & Tomlinson, 2011). In short, the learning process might vary from student to student, so teachers are encouraged to offer a variety of learning options and fit those options to the learning process that best meets the needs of individual students in the class.

Finally, the learning product is of paramount importance because varied demonstrations of learning allow the teacher to determine the students who have mastered the material and those who may need more time and continued instruction (Tomlinson, 1999). Again, the learning styles of the students in the class should help determine what types of products the teacher may wish to accept as demonstrations of learning. In the differentiated learning classroom, it would not be uncommon for a given unit of instruction to have four or five different types of culminating projects that students may choose in order to demonstrate their knowledge of the topic. Art projects, role-play minidramas for groups of students, library or web-based research, digital media portfolios, multimedia projects, as well as paper-and-pencil projects, written reports, or oral reports, all represent excellent projects that students may complete to demonstrate their knowledge (Bender & Waller, 2011b). The various assessment options associated with differentiated instruction are discussed throughout the text.

Using this early view of differentiated instruction, teachers have been expected to modify the instruction in these three areas—content, process, and product—in order to address the individual learning needs of all of the students in the class (Bender, 2008; Tomlinson, 1999; 2010). Furthermore, the teacher's relationship with, and knowledge of, the students in the class was considered the basis for the differentiation, and so the relationship between the teacher and the pupil was and is viewed as critical for effective instruction. Only a solid positive relationship and fairly complete knowledge of the student's abilities, learning styles, and preferences can provide an effective basis for differentiated instruction.

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Multiple Intelligences Theory And Differentiated Instruction

As noted above, Tomlinson based many of her ideas on the theory of multiple intelligences of Dr. Howard Gardner (2006, 1983; Tomlinson, 1999). In short, Tomlinson described the diverse learning needs of students in terms of the various abilities (which Dr. Gardner referred to as intelligences), so in many ways, the early discussions of differentiation were in the early years, clearly tied to the multiple intelligence theory (e.g., Bender, 2008; Chapman & King, 2005). For that reason, some discussion of the multiple intelligences theory is necessary, in order to understand the early perspectives on differentiated instruction.

Dr. Howard Gardner's work on intelligence in children (Gardner, 2006; Moran et al., 2006) has served a crucial function in education, since his work, and other work on learning styles and learning preferences, has refocused how educators understand student learning. Essentially, Gardner postulated eight different intelligences, which he refers to as relatively independent but interacting cognitive capacities (Gardner, 2006; Moran et al., 2006). The eight intelligences that Dr. Gardner considers confirmed are presented in Box 1.1 below. Dr. Gardner has likewise tentatively identified a ninth intelligence (moral intelligence), but does not, as yet, consider the existence of that intelligence confirmed (Gardner, 2006; Sousa & Tomlinson, 2011).

BOX 1.1: GARDNER'S MULTIPLE INTELLIGENCES

Verbal-linguistic: An ability to understand and use spoken and written communications, abstract reasoning, symbolic thinking, and conceptual patterning. Individuals with this strength make excellent poets and attorneys. This intelligence is highly emphasized in schools.

Logical-mathematical: Ability to understand and use logic and numeric symbols and operations, recognize patterns, and see connections between separate pieces of information. These individuals tend to excel in math and related fields such as computer programming.

Musical: Ability to understand and use such concepts as rhythm, pitch, melody, and harmony. These individuals often are highly sensitive to sounds, and will excel in music composition, but note that this intelligences does not necessarily mean the individual has performing talent in each of these areas.

Spatial: Ability to orient and manipulate three-dimensional space. Judgments based on spatial intelligence allow some individuals to shoot a basketball through a hoop 30 feet away with relative ease. These individuals can excel in architecture, mapmaking, and games requiring visualization of objects from differing perspectives.

Bodily-kinesthetic: Ability to coordinate physical movement, or use the body to express emotion. Students with this strength often excel in athletics.

Naturalistic: The ability to distinguish and categorize objects or phenomena in nature, master taxonomy, or demonstrate extreme sensitivity to nature. The ideal occupation for a person with this strength is zoologist.

Interpersonal: An ability to understand, interpret, and interact well with others. Students who seem to "come alive" when working in small-group work represent this type of learner, and the ideal occupation for this person include politics and/or sales.

Intrapersonal: The ability to interpret, explain, and use their own thoughts, feelings, preferences, perceptions, and interests. This ability can assist persons in any job, since self-regulation is one component of success in almost every task. These persons succeed in reflective professions (e.g., authors) and entrepreneurship.

Moral intelligence (the potential ninth intelligence): An ability to contemplate phenomena or questions from a superordinate, moral perspective, beyond sensory data, such as contemplations of the infinite. This is the more recent of these intelligences described, and there are still questions about the reality of this as a separate intelligence.

As described above, these abilities or intelligences seem to exist in almost everyone to some degree, and almost everyone demonstrates strengths in several different intelligences (Gardner, 1983; Moran et al., 2006). Focusing on these intelligences and planning instructional activities with these in mind will, it is believed, result in a wider array of educational activities in the classroom, and various researchers proposed that teachers should consider these intelligences in planning every lesson (Bender, 2008; Chapman & King, 2005; Moran et al., 2006).

We should point out that Gardner's work represents one theory of intelligence and that even the existence of these eight (or nine) separate intelligences has not been independently validated (Sousa, 2006, 2010), and various researchers have questioned these intelligences, and/or the relevance of this theory for education (see the discussion by Sousa, 2010). It is fair to assert that these intelligences are based on Dr. Gardner's expertise and observations, rather than on solid, empirical research. Thus, subsequent research may show that, in reality, only five or six of these nine exist, or that these intelligences are merely behavioral response differences and not actual distinctions in thought processes within the brain. For that reason, some caution is in order here.

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However, even with those cautions in mind, Gardner's work has highlighted several points on which almost all educators agree. First, students do seem to learn in highly diverse ways, and knowledge of these different ways of learning can offer the opportunity for teachers to build instructional activities that involve a number of varied cognitive capabilities. It was in this realm that Tomlinson (1999; 2010) utilized multiple intelligences theory as the basis for advocating increased differentiation in curricular activities.

Secondly, expanding the range of educational activities in the traditional classroom will, in all likelihood, result in enhanced learning, as students with varied learning styles become more cognitively engaged with the content (King & Gurian, 2006; Marzano, 2010; O'Meara, 2010; Silver & Perini, 2010a; 2010b). For these reasons, many practitioners, including this author, have advocated use of this multiple intelligence construct for educational planning purposes over the years (Bender. 2008, 2009a; Sousa & Tomlinson, 2011).

In fact, even Gardner and his colleagues have cautioned against "reductionistic" thinking and educational planning based on this theory (Moran et al., 2006). When presented with this theory, some educators immediately began to plan nine different versions of each instructional activity, and this was clearly not Dr. Gardner's intent (Moran et al., 2006). Rather, these capacities must be viewed in terms of relative strengths and weaknesses that interrelate with each other. Some students demonstrate a particularly strong intelligence in one area, whereas others seem to demonstrate strengths in a "cluster" of intelligences, and effective educational planning should generally offer a variety of opportunities to engage with the learning content using a variety of the learning styles.

Rather than planning nine versions of the same lesson, teachers who wish to address these multiple intelligences are well advised to consider planning in terms of longer units of instruction (Bender, 2008; 2009a). Within a five- or 10-day instructional unit, teachers can provide activities that address the learning styles represented by various intelligences in order to devise an interesting array of highly diverse educational activities. Those various activities would then be targeted to the strengths of the different learners in the class. Wiliam (2011) suggested that students be taught about their own learning styles in order to encourage them to challenge themselves in task selection by choosing tasks that may not be particularly congruent with their own learning style. Teaching Tip 1.1 presents a sample of the types of activities that might be used in a middle-elementary class in a mathematics unit that would tap strengths in each of these intelligences. In a two-week unit on fractions, teachers should be able to implement each of these instructional ideas as either individual or small-group work.

The New Differentiated Instruction

With that brief summary of differentiated instruction and multiple intelligences theory in mind, teachers today must realize that there have been a number of shifts in emphasis that impact differentiated instruction teaching practices today (Bender, 2008; O'Meara, 2010; Sousa & Tomlinson, 2011). Further, several factors that are independent of the differentiated instructional concept

Teaching Tip 1.1

Multiple Intelligence Teaching Suggestions for Mathematics

Verbal-linguistic: Write a description of several fractions, and/or draw a picture to illustrate each.

Logical-mathematical: Describe and evaluate a recipe, then multiply it by two to serve twice as many people.

Musical: Use a chant to learn the steps in reducing fractions, or to memorize multiplication or division math facts. Have students write a "rap" about how to reduce improper fractions.

Spatial: Visualize large objects, and mentally divide them into fractional parts. Draw those objects and fractional parts of them.

Bodily-kinesthetic: Mount a large circle on the wall, from the floor to approximately head high. Have a student stand in front of the circle and use his or her body to divide the circle into fractions. Standing with hands by one's side, the body divides the circle into halves-head to foot. Holding one's arms out straight to each side divides the circle into fourths and so on.

Naturalistic: Explore the core of an apple, cutting it into fractional parts.

Interpersonal: Playing musical chairs, discuss the improper fractions in the game (i.e., five persons circling four chairs is the improper fraction of 5/4). Another idea is to have pairs of kids create fractional parts together by cutting up circles/squares.

Intrapersonal: Have these introspective children keep a daily journal of each experience in their home lives where they experience fractions (e.g., "I wanted more cake last night, so I ate 1/2 of the part that was left over").

Moral intelligence: Have this child reflect on the relationship between one person and the groups to which he or she belongs ("I am 1/22 of this class, and 1/532 of this school, while our class is 22/532 of this school"). Write down these reflections and share them with the class.

have likewise impacted this instructional approach to such a degree that educators today should become aware of these factors, what this author refers to as the new differentiated instruction. This section presents a variety of factors that have impacted the differentiated instructional concept since 1999.

Learning Styles, Learning Preferences, or Intelligences?

As indicated above, the original differentiated instructional concept was developed, to a considerable degree, with the multiple intelligences theory of Dr. Howard Gardner as the basis (Gardner, 1983; Tomlinson, 1999), and while the multiple intelligences construct has served a critically important function in development of this instructional approach, educators today look to a wider variety of learning styles and learning preferences than are typically presented within multiple intelligences theory (Sousa & Tomlinson, 2011; Tomlinson, 2010; Tomlinson, Brimijoin, & Narvaez, 2008; Wiliam, 2011). Thus, to some extent, the very basis of differentiated instruction, as well as for planning differentiated educational tasks within the classroom, has changed somewhat since 1999 (Bender & Waller, 2011b; Sousa & Tomlinson, 2011; Tomlinson, 2010; Tomlinson et al., 2008).

For example, in some of the recent books and chapters on differentiated instruction the multiple intelligences theory is not mentioned at all (O'Meara, 2010; Tomlinson, 2010; Tomlinson et al., 2008), while other books include multiple intelligences along with one or more alternative learning style theories or perspectives on intellectual processing (Sousa & Tomlinson, 2011). This seems to indicate a shift toward more diverse perspectives on learning style, and a wider attention to other student variations within the classroom as the basis for forming differentiated instructional groups (Bender & Waller, 2011b; Sousa & Tomlinson, 2011).

Even the definitions of the terms used in this discussion seem to be somewhat clouded in the literature. In this book, the terms learning style, learning preference, and multiple intelligences are used as if they are roughly synonymous, since most educators, at least in the experience of this author, consider multiple intelligences as one perspective in the broader learning style literature. However, other proponents might advocate against such usage, considering learning styles to be fundamentally different from abilities or intelligences. Learning styles or preferences in some of the literature may, for some, represent choices students tend to make regarding their preferred learning environment (lighter versus darker rooms, or completing only one task at a time versus doing many tasks simultaneously; see Sousa & Tomlinson, 2011). In contrast, the term "intelligences" may be limited to mental processing styles that are relatively independent of the environment, such as the multiple intelligences in Dr. Gardner's original multiple intelligences theory (2006; 1983).

Further, at least two alternative learning or intelligences approaches are considered as appropriate bases for planning the differentiated lesson. First, Robert Sternberg's (1985) triarchic theory of intelligence suggests that students process information and ideas in one of three ways, analytic, practical, or creative, as described in Box 1.2. This description of three "intelligences" has been specifically highlighted recently as one basis for differentiated instructional planning (Sousa & Tomlinson, 2011).

BOX 1.2: STERNBERG'S TRIARCHIC THEORY OF INTELLIGENCE

Analytic intelligence—emphasizes "part to whole" thinking and is typically strongly emphasized in many school tasks. A strength in this area aids in delving into the components or specific aspects of a task or concept.
Practical intelligence—is sometimes described as contextual understanding and emphasizes how concepts apply in real-world settings. A strength in this intelligence would allow a student to problem solve and apply his understandings in different situations.
Creative intelligences—this can best be summarized as "out of the box" thinking. Rather than problem solving with an eye to real-world needs, the creative thinker tends to refocus or reenvision the environment such that novel solutions present themselves.

BOX 1.3: SILVER, STRONG, AND PERINI'S LEARNING STYLES

*Mastery style. S*tudents with this learning style proceed in a step-by-step fashion, focusing on practical implications of the content. These students are highly motivated by success, take pride in developing new understandings, and respond well to competitive and challenging learning tasks.
Understanding style. Students with this style question the content, analyzing the implications of it and fitting the pieces of a construct together. These students want to make sense of the academic content and respond well to puzzles, games, or discussions of controversy.
Self-expressive style. Students with this learning style demonstrate innovative thinking and imagination when undertaking a learning task. They long to be unique in their thinking and original in their approach to any task, seeking understanding that only they have reached. These students respond well to choices in their work and creative assignments.
Interpersonal style. Students with this learning style learn best in the social context, exploring their own feelings or the feelings and understandings of others. These students thrive in cooperative learning situations and are highly emotive in sharing their feelings.

Another conceptualization of students' mental processing styles has been proposed by Silver, Strong, & Perini (2000). These researchers advocated consideration of four learning styles that impact the motivation shown by learners in the classroom, and within that context these authors recommend specific types of instructional tasks for various learners (Silver & Perini, 2010a, 2010b). Box 1.3 presents the four learning styles identified by Silver et al. (2000), and suggestions for the types of learning tasks that might work for various learners.

While other views of abilities, intelligences, and/or learning styles and preferences that impact learning could well be presented in this context, these several perspectives seem to be capturing most of the attention in various discussions on differentiated instruction. Several things are clear in this literature. First, most educators today believe students learn in a variety of ways, and that attention to these learning styles and preferences will positively impact student engagement with the academic content and ultimately student achievement (Bender, 2008; O'Meara, 2010; Silver & Perini, 2010b; Sternberg, 2006; Sousa, 2010; Tomlinson et al., 2008). Next, educators around the world are today encouraged to implement differentiated instruction in order to provide learning activities that address some of these varied learning styles and preferences. For example, as reported by Berkeley, Bender, Peaster, and Saunders (2009), virtually every RTI plan implemented in the various states stressed differentiated instruction as the cornerstone of general education instruction.

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Thus, discussions of differentiated instruction today focus more broadly on differences in general learning styles and individualized or small-group learning center instruction for either heterogeneous or homogeneous groups based on these learning styles. One might well say that, in contrast to 1999, the differentiated instructional paradigm is now free from dependency on only one theory of intelligence (Sousa & Tomlinson, 2011).

Brain Physiology, Learning, and the New Differentiated Instruction

In addition to the broadening theoretical basis for differentiated instruction, there are other changes in emphasis within the broader differentiated instructional paradigm. In particular, the work on the physiology of learning process has come to influence the differentiated instructional approach much more since 1999 (Sousa & Tomlinson, 2011). Of course, much of the work on the physiology and neurochemistry of learning has been undertaken since the original differentiated instructional concept was described by Tomlinson (1999), and this research, both theoretical and practical in nature, has clear implications for differentiating instruction in both reading and mathematics (Bender, 2009a; 2008; Caine & Caine, 2006; Coch, 2010; Devlin, 2010; Shah, 2012; Sousa, 2010; Sousa & Tomlinson, 2011).

> Much of the work on the physiology and neurochemistry of learning has been undertaken since the original differentiated instructional concept was described by Tomlinson.

Often referred to as brain-compatible learning, this research is now providing a more solid basis for differentiated instruction than did the multiple intelligences theory in isolation. Thus, a more research-based theory for differentiated instruction is developing, and has been discussed as a more solid scientific basis for differentiated instruction (Sousa & Tomlinson, 2011; Bender & Waller, 2011a). More information on this brain-compatible research, and the differentiated instructional suggestions stemming from that research, is presented later in this chapter.

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Next, differentiated instruction today is more broadly focused than the original differentiation concept (Tomlinson, 2010; Sousa & Tomlinson, 2011). Initially, differentiated instruction focused on the three areas presented above, differentiated content, process, and product (Tomlinson, 1999), and differentiated instruction groups were based on the various multiple intelligences in order to strengthen student learning. However, today while differentiated instruction still stresses these three ideas, other areas are likewise considered essential for differentiated instruction, including respect for the learner, a powerful, engaging curriculum, flexible groupings for academic tasks based on student interest, student readiness, as well as learning preferences, ongoing assessment and a positive learning environment, attuned to student needs (Sousa & Tomlinson, 2011). As these areas continue to increase, the concept of differentiated instruction continues to broaden over time.

Recent Initiatives Impact Differentiated Instruction

With these modifications of the original differentiated instructional concept in mind, there are at least two other factors that have impacted differentiated instruction. First, the differentiated instruction concept has been and will be transformed, based on the increasing use of technology in the classroom (Bender & Waller, 2011b). While differentiated instruction has always emphasized consideration of students' learning styles, strengths, and the formation of instruction groups based on those, the increased availability of technology, social networking, and computerized curricula in the classroom today allows for a totally differentiated instructional program.

In fact, placing students individually in appropriate, engaging, well-designed computer-based curricula might be envisioned as the epitome of differentiated instruction, since such well-designed curricula do deliver individualized instruction that is highly targeted to students' individual needs and based on their individual academic levels. In many modern computer programs, educators can vary the amount of stimulation that the program delivers to the student during the lesson, thus addressing some of the factors associated with varied learning styles. These might include variations in the way problems are presented (e.g., the amount of color, or noise, or animation used), or the level of instructional assistance provided. Even the timing may be varied in modern computer-based curricula (i.e. the rate of presentation of the questions, etc.).

All of these possible variations allow educators to tailor the computer-based instructional presentation to students with various learning styles, and thus, this can be considered highly differentiated instruction (Bender & Waller, 2011b). While some computer-based instructional programs have offered many of these variations for at least 25 years, today most programs do, and teachers are becoming adept at using these options to provide differentiated instructional assignments for their students. Thus, computer- and Internet-based instruction today hold much more potential for allowing teachers to differentiate instruction than was the case in 1999.

However, technology is impacting instruction in many ways today that go far beyond merely effective computer-based instructional programs. Various social networking options (e.g., Facebook, Twitter, or Ning), use of wikis or class blogs for instructional collaborations, and creation of content offer instructional options that have not, as yet, been conceptualized as methods for differentiating instruction. Indeed, most of the recent books focused on modern instructional technology in the classroom have not mentioned differentiated instruction at all (Ferriter & Garry, 2010; Richardson & Mancabelli, 2011). Clearly this oversight needs to be addressed, as not only can individual computerized curricula aid in our efforts to differentiate instruction, but more recently developed (and developing) networking technologies can aid the differentiated effort as well, as students choose their role in various learning projects in their effort to create their own learning content (Bender & Waller, 2011a). Students are demonstrating, via their nonschool behaviors, that they love social networking, and as educators grow in our understanding of how these social networking tools may be used in education, many opportunities for increased differentiation of instruction are likely to result. The impact of technologies for teaching on differentiation is presented in more detail in Chapter 3.

Most of the recent books focused on modern instructional technology in the classroom have not mentioned differentiated instruction at all.

Another instructional innovation that has transformed and continues to transform education today is the response to intervention initiative (RTI). RTI represents a mandate to deliver multi-tiered levels of supplemental instruction for students in the classroom, in order to assure that students' instructional needs are met with the exact level of instructional intensity necessary to assure their success (Bender, 2009b; Bender & Crane, 2010; Bender & Shores, 2007). Of course, the provision of supplemental, intensive instruction is much less necessary if a wider variety of instruction needs are met within the general education classroom. That is why, in many states, the differentiated instructional paradigm was "written into" or required by the various state plans as the basis for all Tier 1 instruction within the RTI initiative (Berkeley et al., 2009). More detail on the impact of RTI on differentiated instruction for students with learning disabilities is presented in the assessment chapter, Chapter 4.

Finally, the implementation of Common Core State Standards in education by the 46 states that have chosen to participate in the Common Core is likely to impact how teachers differentiate instruction in their classes. For this reason, a brief introduction to the Common Core State Standards and the issues surrounding them is presented below.

Conclusion: The New Differentiated Instruction

These factors, taken together, have resulted in a new understanding of differentiated instruction. The increased emphasis on the physiology of learning using modern instructional technologies for teaching implementation of Common Core State Standards and differentiation within the RTI paradigm—a paradigm that is driving education today—have all merged to create a new differentiated instructional paradigm, and in this instance, the whole is greater than the sum of the parts (Bender & Waller, 2011a). That is, each of these instructional innovations has become transformed by interaction with these other factors, and the resulting educational procedures currently evolving do not greatly resemble traditional educational practices.

COMMON CORE STATE STANDARDS AND DIFFERENTIATION

> The Common Core State Standards promise to significantly impact how instruction is undertaken over the next decade.

By 2012, 45 states had decided to adopt the Common Core State Standards (Toppo, 2012). Only Texas, Alaska, Nebraska, Minnesota, and Virginia have not adopted these standards, meaning that most teachers will be working within the context of the common core standards. Clearly the Common Core State Standards promise to significantly impact differentiated instruction over the next decade, so some understanding of those standards is essential for determining how teachers might differentiate their instruction.

The Common Core State Standards were developed by the National Governors Association Center for Best Practices and the Council of Chief State School Officers in collaboration with teachers, school administrators, and curriculum experts in order to provide a clear and consistent framework to prepare our children for higher education and/or the workforce (see http://www.corestandards.org/the-standards).

Initially, standards were developed by expert teams, and input was solicited from many sources including various teacher organizations, higher education educators, civil rights groups, and advocates for students with disabilities. Following the initial round of feedback, the draft standards were opened for public comment, and nearly 10,000 responses were considered in preparing the final standards. The standards in reading and mathematics were finalized and initially released in 2010. These standards represent, in participating states, the instructional content that students are expected to learn. Further, the standards are intended to provide appropriate benchmarks for all students, regardless of where they live. They are described by the developing agency as clear and consistent, rigorous with an emphasis on higher-order skills, and evidence based.

Because these standards are intended to represent a common core for instruction across states, in some cases there is little difference between the current state standards in reading and/or mathematics and the Common Core standards. For example, the Common Core standards still call for fluency in addition and subtraction by the end of Grade 3, and that is quite common in many existing state standards (Wurman & Wilson, 2012). In that sense, implementation of these standards may be more involved in some states than in others.

Still, implementation activities involving the Common Core are ongoing, and as of Spring 2012, various organizations have partnered together for curriculum development and professional development activities. For example, in May 2012, Universities and school districts from 30 states have partnered together to foster implementation of the Common Core State Standards for Mathematics, though the scope of this partnership has yet to be determined (Sawchuk, 2012).

In addition to the Common Core State Standards, and the Standards for Mathematical Practice, two different teams at the national level are developing common assessments for the Common Core State Standards for Mathematics and for English Language Arts (Shaughnessy, 2011). Once these different assessment frameworks are developed, it is anticipated that all participating states will choose which framework to implement in addition to their Common Core instruction. While that work is ongoing as of 2012, the implementation of these Common Core assessments in reading and mathematics is currently scheduled for 2014. Information on these assessments in mathematics is presented at the website of the National Council of Teachers of Mathematics (http://www.nctm.org/uploadedFiles/Research_News_and_Advocacy/Summing_Up/Articles/2011/AchieveCOMAPPARCC(1).pdf#search=%22Common Core Assessment Plans%22). As this discussion indicates, much work is ongoing as of 2012 in reading and mathematics instruction, and this will impact how teachers deliver differentiated instruction in their classes for the next decade.

As this indicates, a major national effort is under way to implement the Common Core State Standards. While most educators are supportive of the Common Core State Standards, there are many who have raised concerns about the Common Core standards, even prior to the implementation date of 2014 (Loveless, 2012; Tucker, 2012; Ujifusa, 2012; Wurman & Wilson, 2012). In early 2012, Tom Loveless published a report, "How Well Are American Students Learning?" as one of the Brown Center's Reports on American Education, published by the Brookings Institution (http://www.brokings.edu/reports/2012/0216_brown_education_loveless.aspx).

That Brown Center report that was largely critical of the idea that setting rigorous academic standards enhances academic achievement, though that conclusion was based on academic achievement data related to previous state standards in various states rather than the Common Core standards themselves, as the Common Core State Standards have yet to be implemented, as of 2012. Still, that conclusion ignited a firestorm among educational leaders (Hess, 2012; Loveless, 2012; Tucker, 2012). Specifically, Loveless (2012) argued that adoption of earlier state standards was not related to achievement scores on the National Assessment of Educational Progress from 2003 through 2009. Further, he concluded that there was little evidence that setting standards can close achievement gaps between groups (Loveless, 2012).

Independent of the debate on the impact of the Common Core on student achievement, other concerns with these standards have arisen, and several advocacy groups in education have gone on record as opposing these standards (Ujifusa, 2012). The Common Core State Standards were intended to be more simple and streamlined than the standards adopted by the individual states previously while demanding increased performance, but some have suggested that standards in mathematics for many states (e.g., California and Minnesota), were more rigorous than the Common Core State Standards (Wurman & Wilson, 2012). Clearly, this critique, if true, would defeat the purpose of the entire Common Core standards effort, and needless to say, this major national effort is likely to cost millions of dollars across the nation.

In conclusion, it is not yet known how effective the implementation of the Common Core State Standards will be over the next decade. However, all teachers in participating states can anticipate extensive involvement with these standards, and thus, this will impact teacher's efforts to differentiate instruction. Thus, any description of differentiated instruction must be framed in the context of the Common Core State Standards in reading and mathematics.

BRAIN-COMPATIBLE INSTRUCTION IN THE DIFFERENTIATED CLASSROOM

As indicated previously, the emerging research on brain functioning has provided a solid foundation for differentiated instruction since the concept was introduced in 1999 (Bender, 2009a; Bender & Waller, 2011b; Shah, 2012; Sousa & Tomlinson, 2011). While related in a general way to the concept of multiple intelligences, the literature on brain-compatible instruction is much more solidly grounded in the neurosciences (Caine & Caine, 2006; Shah, 2012; Simos et al., 2007; Sousa. 2006, 2010). However, like multiple intelligences, the instructional ideas stemming from the neurosciences provided Tomlinson (1999) with another foundation for differentiated instruction (Sousa & Tomlinson, 2011).

Brain-compatible instruction has emerged since 1990, primarily based on improvements in the medical sciences (Caine & Caine, 2006; Shah, 2012; Simos et al., 2007; Sousa, 2010). In fact, much of our increasing understanding of the human brain has come from the development of the functional magnetic resonance imaging techniques (a technique that is sometimes represented in the literature as the fMRI). This is a non-radiological technique—and thus a relatively safe brain-scanning technique—that has allowed scientists to study the performance of human brains while the subjects concentrated on different types of learning tasks. The fMRI measures the brain's use of oxygen and sugar during the thinking process, and, from that information, physicians can determine which brain areas are most active during various types of educational tasks (Sousa, 1999). For example, specialists have now identified brain regions that are specifically associated with various learning activities such as language, reading, math, motor learning, music appreciation, or verbal response to questions in a classroom discussion (Sousa, 2006, 2010).

Caine and Caine (2006), two leaders in the field of brain-compatible instruction, refer to learning in terms of *cognits*, which are defined as organized configurations of brain cells that activate together and result in a unified thought. These may range from simple cognits, which represent a single fact, to much more involved cognits that might be activated to handle more complex information. From this perspective, the teacher's role is to provide instructional experiences that are rich in learning potential and thus develop more and/or increasingly complex cognits.

For example, having a student complete a written problem involving the addition of negative 2 plus positive 3 activates a number of different cognits within the brain, and thus can result in learning. However, having that same student "walk through" the same addition problems using a number line of positive and negative integers on the floor activates many more cognits within the brain, and thus results in higher impact learning—both increased understanding and enhanced memory. Further, Caine and Caine (2006) have specified the types of high impact activities students should engage in when presented with new material in the class. Students should

- undergo sensory and emotional experiences tied to the content, because sensory and emotional tags associated with content learning enhances memory;
- make associations with previous knowledge and their own experiences;
- articulate questions and develop a focus that leads to planning their activities on the content;
- perform some movement or action related to understanding the content or produce some product associated with it; and
- be challenged with high quality curricula that are minutely more challenging than tasks the student is known to perform independently.

GENERAL CONCLUSIONS FOR BRAIN-COMPATIBLE TEACHING

Thus, the neurosciences are now providing some general information that will inform instructional practices in the differentiated class (Bender, 2009a; Doidge, 2007; Merzenich, 2001; Shah, 2012). First, studies are now under way using the fMRI technology to attempt to predict which kindergarten students might experience reading difficulties in later school years (Shah, 2012). This diagnostic application of neurosciences may provide information that allows educators to intervene earlier in the education process for those students. Also, several actual curricula have been developed using the emerging insights from the neurosciences (Doidge, 2007; Shah, 2012). Thus, both the diagnostic process and educational interventions for the differentiated classroom are now based, in part, on this emerging area of science.

Some authors have even presented syntheses on what this brain-compatible research may mean in the classroom, and while there is little consensus, several tentative conclusions have emerged. First, engaging our students' brains in active, deep thought on the content is critical for higher level conceptual learning (Bender, 2008; Doidge, 2007; Merzenich, Tallal, Peterson, Miller, & Jenkins, 1999; Merzenich, 2001; Shah, 2012). While many different proponents have provided instructional guidelines, the key is to engage students' brains with critical content in a fashion that stimulates maximum brain involvement. Teaching strategies and activities that engage brains in that fashion seem to enhance student achievement overall (Doidge, 2007; Merzenich et al., 1999; Merzenich, 2001; Shah, 2012; Silver & Perini, 2010a; Sternberg, 2006; Tate, 2005), since they are more likely to lead to long-term retention, than more traditional instructional techniques.

> The key to teaching is to engage students' brains with critical content in a fashion that stimulates maximum brain involvement, and teaching strategies and activities that engage brains more enhance student achievement overall.

Next, extensive cognitive engagement with the critical content in an instructional unit may be more critical in learning than "content coverage" for overall mastery of the content (Bender & Waller, 2011b; Shah, 2012).

Therefore the idea of "teaching less content, but teaching it more thoroughly" is a sound teaching principle across the public school grades (Fogarty & Pate, 2010).

Next, effective teaching involves creating exciting, innovative differentiated learning activities that will actively engage today's students with the learning content in a rich, meaningful, highly involved manner (Bender, 2008; 2009a; Doidge, 2007; Shah, 2012; Tomlinson & McTighe, 2006). Today's students expect and respond to nothing less than the stimulation they have grown used to in today's digital, media rich, highly interactive and technological world, and teachers must structure their instruction to approximate that modern world, in order to reach students today. Thus, using brain-compatible teaching ideas, coupled with modern technologies to engage our students is now critical. Teachers must create differentiated learning activities that emulate the high tech world of our students, and on that basis instruction is much more likely to be more effective (Bender & Waller, 2011a, 2011b; Gregory, 2008).

Next, to the degree possible, teachers should create "authentic" learning environments in which students actually "experience" the content and/or produce the content, rather than merely read about it, discuss it, or study it (Larmer, Ross, & Mergendoller, 2009). Interactive activities such as creation of podcasts, Internet searches, and group projects based on web-based collaborative development tools are likely to enhance learning much more than traditional "read, discuss, and test" instruction. Such "experiential learning" will result in deeper understanding and longer-term learning of the content in question (Sternberg, 2006).

Recent Discoveries on Learning

While this single text cannot present the exciting array of recent findings from the neurosciences, several additional discoveries bear directly on discussions of the ways students experience learning in the classroom. First, within the last several years, a set of neurons commonly called "mirror neurons" have been identified within the human brain (Goleman, 2006; Sousa. 2006). These neurons allow human beings to create internal, mental simulations of what is going on in the minds or emotions of other people in their environment. Thus, when two people interact, their minds are actually influencing each other (Goleman, 2006), and they are likely to increasingly reflect each other's moods and emotions. In fact, they are quite likely to begin to "match" each other on such things as voice volume, voice tone, emotional intensity, or even facial expression and body language, depending on the degree and level of intensity of the interaction. Thus, when teachers or students are unhappy in the context of an educational activity, the other students in the class are somewhat predisposed to reflect that in their own moods, emotions, and possibly even their actions (Sousa, 2006, 2010).

Next, brains perform at their best when they are highly motivated and involved and experiencing "manageable" stress (Goleman, 2006). Should a student experience too much stress (e.g., when presented with a math problem he or she cannot do and is expected to perform that problem on the dry-erase board in front of the whole class), energy is shunted into the emotional centers of the brain, and the cerebrum or "cognitive area" of the brain actually demonstrates reduced brain activity. Thus, higher order thinking—which takes place in the cerebrum—decreases when students are overstressed in the classroom.

With these neuroscience concepts in mind, it is easy to understand why some instructional environments don't work for many students, including many students with learning disabilities. Students with learning disabilities and other learning problems are more likely to be stressed in the classroom environment and may therefore engage less with the academic content. Taken together, what these findings suggest is that if students do not experience their learning as a warm, positive environment that challenges them at an appropriate level—a level of task which, while challenging, is at least within the realm of the possible for them—those students will actually become less capable of learning as the brain activity in the cerebrum decreases. Thus, every teacher is obligated to ask, "How do all of my students—particularly students with learning disabilities or other learning challenges—experience learning in the context of my classroom?"

Specific Instructional Guidelines for Struggling Students

In addition to these issues raised by the neurosciences, other researchers have suggested that the research on brain-compatible instruction has developed to a point where specific teaching suggestions can be made. On the basis of this research, teachers across the nation have begun to restructure their classroom practices based on these guidelines (Moran et al., 2006; Sousa. 2001, 2010). Although various authors make different recommendations, the 10 tactics for a brain-compatible instruction classroom, presented in Teaching Tip 1.2, represent the accumulated thought in this area (Bender, 2008; Moran et al., 2006: Shah, 2012; Sousa, 2010; Sousa & Tomlinson, 2011; Sternberg, 2006).

Teaching Tip 1.2

10 Tactics for Brain-Compatible Teaching

1. Create a Safe and Comfortable Environment
2. Use Comfortable Furniture, Lighting, Ambiance
3. Offer Water and Fruits Where Possible
4. Encourage Frequent Student Responses
5. Teach Using Bodily Movements to Represent Content
6. Teach With Strong Visual Stimuli
7. Use Chants, Rhythms, and Music
8. Offer Appropriate Wait Time
9. Offer Student Choices
10. Foster Social Networking Around Learning Content

From *Differentiating Instruction for Students With Learning Disabilities: Best Teaching Practices for General and Special Educators,* Second Edition, by William N. Bender. Thousand Oaks, CA: Corwin, 2008. Used with permission.

Create a Safe, Comfortable Environment. Research on learning has demonstrated that the brain serves as a filter on several levels. First, the brain selectively focuses on sounds, sights, and other stimuli that threaten our safety, often to the exclusion of other stimuli. A second priority is information resulting in emotional responses, and only as a last priority does the brain process information for new nonthreatening learning tasks (Sousa. 2001). Thus, based on this filtering or prioritizing brain function, several implications for the classroom come to mind. Clearly, students must not be distracted by a sense of danger in their learning environment: They must feel safe and comfortable in order to be prepared to focus on new material (i.e., the school curriculum) that, by its very nature, is usually not threatening. For students who come from violent homes or communities, who may be picked on at school, or who may frequently feel punished by the school environment, learning new material will be almost impossible. However, physical safety is not enough; for students to feel comfortable, students must feel emotionally secure. Thus, a positive personal relationship with the teacher is paramount. Only in the context of such a comfortable, caring relationship will students with learning disabilities turn their attention to mastering new tasks.

Of course, this holds serious implications for students with learning disabilities because some students may suffer from a sense of frustration in certain classrooms. Students with disabilities may even experience some school classes as "hostile terrain" in which they are frequently punished by either their continuing failure in learning tasks or by the teacher. Clearly, this classroom environment will not support strong academic success for those students.

Use Comfortable Furniture and Lighting. As a part of structuring a comfortable learning environment, many teachers bring "house furniture" into the classroom and set up reading areas with a sofa and perhaps several comfortable chairs. Lamps are also used in brain-compatible classrooms for more "homelike" lighting, and some research has suggested that lighting closer to the red end of the light spectrum functions like a "wake-up" call for the brain.

A moment's reflection on the hardness of the wooden desks in most of our nation's classrooms—desks where students must sit for up to five hours each day—makes this a critical concern for many teachers. How would any adult like to sit at those wooden desks for five or six hours each day for an entire year? A different type of furniture can make our classrooms more user-friendly and facilitate learning.

Offer Water and Fruits If Possible. Research has shown that the brain requires certain fuels—oxygen, glucose, and water—to perform at peak efficiency (Sousa, 2001, p. 20). Up to one fourth of the blood pumped in our bodies with each heartbeat is headed for the brain and central nervous system, and water is critical for even blood flow. Furthermore, water is essential for the movement of neuron signals through the brain (Sousa, 2006). Finally, we now know that fruits are an excellent source of glucose for the brain, and research has shown that eating a moderate amount of fruit can boost performance and accuracy of word memory (Sousa, 2001, 2006). Thus, in brain-compatible classrooms, individual water bottles are usually present on the desks for students to take a sip whenever they need to: water is not a once-an-hour privilege in the brain-compatible class. Also, many teachers offer light fruits as snacks.

Encourage Frequent Student Responses. Students will learn much more when work output is regularly expected from them because students are generally much more engaged in the process of learning when they must produce a product of some type. In fact, students with learning challenges need more practice with newly learned concepts than do other students (Shah, 2012), and this usually means that students should produce more. Note once again the differentiated instructional emphasis on the products of learning. Students must be required to do assignments, either in the form of projects, class work, or homework on any new material that is presented. The frequency of work expected from the students will be a major determinant of how much information students retain. However, the required work output doesn't have to be an entire page of problems—more frequent output of only a few problems each time will be much more useful in the learning process for students with learning disabilities (Sousa, 2001, 2006). More frequent, shorter assignments also give the teacher additional opportunities to check the students' understanding of the concepts covered.

Teach With Bodily Movements to Represent Content. Have you ever wondered why motor skills such as swimming seem to be retained for life, even without routine practice, whereas use of a foreign language quickly atrophies if it is not practiced? Recent brain research has shown that motor skills represent a deeper form of learning than merely cerebral learning, which is why movement is now recommended as a highly effective teaching tool (Sousa, 2010). Motor skills, once learned, are remembered much longer than cognitive skills that do not involve a motor response, and this suggests that, whenever possible, teachers should pair factual memory tasks with physical movements.

Recent brain research has shown that motor skills represent a deeper form of learning than merely cerebral learning, which is why movement is now recommended as a highly effective teaching tool.

The emerging research on the human brain has addressed this question concerning motor learning versus higher order cognitive learning, and two findings have emerged (see Bender, 2008). First, learning of motor skills takes place in a different area within the brain—the cerebellum, which involves a more basic level of thought than thought in the cerebrum, such as the learning of languages. Secondly, the brain considers motor skills more essential to survival. Because our ancient ancestors often had to run away from predators or, alternatively, had to hunt for their own food in order to survive, motor learning, which generally takes place in the cerebellum, has been prioritized by the brain as a survival skill. Thus, cognitive facts that are frequently paired with motor movements are learned in a deeper way and typically retained longer. In contrast, language or reading skills such as interpreting the shape of the letters in a word takes place in the cerebrum, and is generally interpreted by our brains as a lower priority than movement and other survival skills. Even in the upper grades, various memory tasks can be represented by physical movement, and this will greatly enhance retention for students with learning disabilities as well as most other students (Sousa, 2010).

An example of a movement technique for learning the location of the continents is presented in Teaching Tip 1.3. Note how this movement associates specific bodily orientation with locations of the continents on a world map. This use of movement to teach content is appropriate across the grade levels, and involves a change in the process of learning for students who seem to do better with physical movement as a learning support. The contents of other maps can easily be represented with body parts, as can various other learning tasks (e.g., parts of a business letter or personal letter, or any content in which concepts are graphically related to each other—e.g., parts of a cell).

Teaching Tip 1.3

Teaching With Movement: Locations of the Continents

Chapman (2000) shared an instructional strategy for middle and upper grades using movement to teach locations of the continents. While facing a map of the world on the wall, the students should be told to imagine their bodies superimposed over that map. In that position, the following movement and chanted lines will facilitate learning the locations of the continents. Note that the body parts focused on by the movements below represent the actual locations of the continents on the map.

1.	Extend the left arm with hand open, pointing away from the body	Say "This is North America, where we live."
2.	Move right fist to touch forehead.	Say "This is Europe."
3.	Stick right hand out, palm up, and touch that with the left fist.	Say "This is Asia."
4.	Put both hands on hips.	Say "This is the equator."
5.	Put hands together over one's belt, making a diamond (i.e., thumbs up and touching each other, and index fingers pointing down touching each other).	Say "This is Africa."
6.	Move the thumbs together (while holding the position above).	Say "Part of Africa is above the equator."
7.	Move index fingers (while holding the position above).	Say "Part of Africa is below the equator."
8.	Stick out left leg.	Say "This is South America."
9.	Stick out right leg.	Say "This is Australia."
10.	Bend over and point to the floor.	Say "This is Antarctica. It's cold down there!

Adapted from Chapman, C. (2000). "Brain Compatible Instruction." A paper presented on a nationwide tele-satellite workshop. *Tactics for Brain Compatible Instruction,* the Teacher's Workshop. Bishop, GA.

Teach With Strong Visual Stimuli. Although teachers have known that visual stimuli often enhance learning, this commonsense insight has been confirmed by the brain-compatible instructional literature (Sousa, 2006). There is evidence that boys, in particular, respond more positively to strong, color-enhanced visual stimuli and that boys' brains and visual receptors may be more attuned to moving stimuli than young girls' (King & Gurian, 2006). Therefore, teachers should use color enhancements, size, and shape enhancements in developing lesson materials posted in the classroom because the human brain and central nervous system are specifically attuned to seek out novelty and differences in stimuli (Sousa, 2001, 2006). Thus, highlighting the topic sentence of the paragraph in a different color for students with learning disabilities can be of benefit for them in describing the topic of the paragraph. Likewise, using different colors for different parts of speech (red for nouns, blue for verb, green for adjectives, etc.) can facilitate learning. Also, if possible, teachers should use moving stimuli such as video examples to illustrate academic content.

However, to make color an effective learning tool, the teacher and the student (or the class) should specifically discuss why certain aspects of the material are colored differently and the importance of those colored items. Many computer-driven instructional programs are making use of this technique today and include color highlights or size variations to teach syllabication and other reading skills. Again, this represents a modification of the learning processes for students with various learning challenges.

Use Chanting, Rhymes, and Music. Because music and rhythms are processed in a different area of the brain from language, pairing facts to be learned to a musical melody, or a rhythmic chant, can enhance learning (Tate, 2005). Most adults, on reflection, can remember the song that was frequently used to memorize the ABCs—the tune to *Twinkle, Twinkle Little Star*—and many students used that same song for other memory tasks in the higher grades—the periodic table or division math facts. Again, teachers have used this insight for a number of decades, but the emerging research on the human brain has documented the basis for enhanced learning when music and rhythms are used to enhance memory for the academic content (see Tate, 2005).

Assure Appropriate Wait Time. Students have learned that teachers will often call on the first one or two students who raise their hand after the teacher has asked a question in class. Thus, all that students with learning disabilities have to do is remain "invisible" for a few seconds (i.e., not raise their hand and not look toward the teacher), and the teacher will usually call on someone else. On average, teachers will wait only one or two seconds before calling on someone for an answer, and this period of time between the question and when an answer is called for is defined as "wait time" (Sousa. 2001).

However, students process information at different rates, and the brain research has demonstrated the importance of waiting for a few seconds (perhaps seven to 10 seconds) after asking a question prior to calling on someone for the answer. This increased wait time gives students who process information more slowly and deliberately a period of time to consider their answer and, it is hoped, raise their hand to volunteer a response to the teacher's question. For this reason, adequate wait time can be a critical component of learning for students with learning disabilities, many of whom do process information more slowly than others in the class.

Offer Student Choices: Various educators today emphasize the importance of student choice in the activities they undertake (Larmer, Ross, & Mergendoller, 2009). In short, if teachers want their students to make reasonable and informed choices when they are not in the context of the school, teachers must offer choices within the classroom, and coach students in making informed choices. Such choices may involve the options for demonstrating competence or understanding a set of facts or other choices among assignments on a particular topic, and in a highly differentiated classroom, students will be offered many choices and are likely to use their own understanding of their learning styles and preferences to make such choices.

Use Social Networking for Learning. It has often been noted by veteran teachers that having students explain new information to other students can enhance learning, and the emerging research on the human brain has once again supported this instructional procedure. Further, the frequency with which most students today participate in social networking indicates a general preference for social learning opportunities within the classroom (Rushkoff & Dretzin, 2010). Teachers should get in the habit of presenting some information in shorter time frames and then let students discuss that information together, thus enhancing the opportunity for social networking on the academic content. In fact, the brain research suggests presenting new information at the beginning of the period for between 10 and 20 minutes (Sousa, 2001), and then pausing to ask students to reflect together on the new information.

Further, students are demonstrating by their own actions that they enjoy learning in the context of a social environment. Most students today engage in social networking using Facebook and other such platforms for many hours each week, and, on average, teenagers in 2012 text approximately 3,000 times per month, or over 100 times daily (Bender & Waller, 2011a; List & Bryant, 2010; Rushkoff & Dretzin, 2010). As more student choice is offered in the classroom, students are quite likely to choose social networking as one basis for learning, and this represents an option for providing differentiated activities that could not have been foreseen previously. The use of social networking for instruction using modern communications technologies is discussed in more detail in Chapter 3.

Efficacy of Differentiated Instruction

With all of the emphasis now placed on brain-compatible, highly differentiated instruction, it may come as a surprise that the research supportive of differentiated instruction is still somewhat limited. To date, there has been no systematic empirical research on differentiated instruction and its potential impact on student achievement. In an educational world of "show me the data," this lack of empirical research for differentiated instruction is somewhat surprising. In particular, more than a decade of time has now passed since differentiated instruction was introduced in 1999 (Tomlinson, 1999), and one may well ask, where is the supportive research?

In response, there is a growing body of evidence, much of which is anecdotal, that is suggestive of the positive impact of differentiated instruction

(King & Gurian, 2006; Tomlinson et al., 2008). This limited research does suggest the positive impact of differentiated instruction coupled with increased brain-compatible instructional activities on student achievement (Caine & Caine, 2006; Doidge, 2007; King & Gurian, 2006; Lee, Wehmeyer, Soukup, & Palmer, 2010; Merzenich, 2001; Merzenich et al., 1999; Tate, 2005; Tomlinson, 2010; Tomlinson et al., 2008; Silver & Perini, 2010b; Sousa, 2005, 2009, 2010; Sternberg, 2006).

> There is a growing body of anecdotal evidence that is suggestive of the positive impact of differentiated instruction.

As one example, Tomlinson and her coauthors (2008) presented evidence of academic improvement in two schools as a result of implementation of differentiated instructional practices. Conway Elementary School and Colchester High School were described as two ordinary schools in different districts of the United States, though student performance at Colchester High was somewhat weaker than achievement at Conway Elementary, prior to the initiation of differentiated instruction (Tomlinson et al., 2008). Results are presented in terms of percentages of students demonstrating advanced or proficient scores on normative assessments for several years prior to the implementation of differentiated instruction and for several years after implementation.

Data at Conway Elementary School indicated that decidedly more students are achieving proficiency and/or testing at the advanced level after a three-year implementation of differentiated instructional practices. In fact, the data after the first year of implementation, showed a decided increase in student achievement (Tomlinson et al., 2008). All of these data clearly show no substantive change in other schools' achievement during these years, but when Conway Elementary implemented differentiated instruction, student achievement scores jumped as much as 30% in some academic areas.

Data for Colchester High School include the number of students passing the statewide assessment in reading, writing, and mathematics. Again, these data represent the percentage of students meeting educational goals both before and after differentiated instruction was implemented. These assessment results from Colchester High compare scores in the specific core subjects of reading, writing, and mathematics, and, in every area, students' achievement increased after the school implemented differentiated instruction.

Other results document the efficacy of brain-compatible teaching tactics within a differentiated instructional paradigm. For example, in a schoolwide implementation study, King and Gurian (2006) described a school in Colorado in which teachers noted a sharp achievement gap—a gap of 21% points on the state reading test—between young males and young females. Males were falling behind females consistently in the reading curriculum, and the faculty became concerned and began to study the matter. They looked into research on brain-based gender differences and concluded that their instructional practices favored the brain-based learning styles of young girls more than the learning styles of young boys. Further, they concluded that the actual reading curriculum in use likewise favored the learning styles and preferences of young girls.

In particular, when students were presented with an array of reading materials, males and females chose different topics (King & Gurian, 2006). Males chose to read topics with more conflict between characters and very clear role distinctions between heroes and villains. They often chose reading topics with a hint of danger, aggression, and stories that involve clear winners and losers, including reading material on topics such as NASCAR, football, atomic bombs, battles, or animals fighting (King & Gurian, 2006). In contrast, females tend to avoid reading material that represents high levels of overt conflict, preferring topics such as relationships, deep friendships, or fantasy material (e.g., mermaids and unicorns). Further, the teachers then investigated the stories in the basal reading curriculum and found that the stories that appealed to young girls' interests clearly outnumbered the stories that would appeal to boys.

With this information in hand, the faculty collectively determined to supplement their reading curriculum with additional stories that were of more interest to males (King & Gurian, 2006). Also, having studied the differentiated instruction and brain-compatible instructional literature, teachers began to teach with more attention to novel stimuli, conflict, and movement-based instruction, as recommended within that literature. As a result of these differentiated instructional modifications, the school was able to effectively close the reading achievement gap between young males and young females in only one year. While this is clearly an anecdotal example, this result nevertheless does indicate the potential for highly differentiated brain-compatible instruction to enhance academic achievement (King & Gurian, 2006).

As a result of these differentiated instructional modifications, the school was able to effectively close the reading achievement gap between young males and young females in only one year.

THE NEW DIFFERENTIATED INSTRUCTION

As this summary indicates, the construct of differentiated instruction has changed somewhat since its inception in Tomlinson's critically important book (1999). Today, many views of learning styles and preferences are used as the basis for differentiation, and factors such as academic variation are used, in addition to learning style preferences, when forming instructional groups for differentiated activities in the classroom. Further, both technology and the RTI initiative have impacted teachers' differentiated instructional efforts, since each can greatly enhance the delivery of highly targeted instructional support for all students in the class. Thus, this author has chosen to use the term *The New Differentiated Instruction* to emphasize these modifications to the differentiated instructional paradigm, and to represent what differentiated instruction may mean in the years to come.

WHAT'S NEXT?

In the next chapter, I present the concept of universal design as a basis for classroom organization for differentiated instruction. The instructional practices noted above, such as using movement for instruction, and effective use of modern instructional technologies will also be highlighted. Finally, four different models for differentiating instruction in the context of a universally designed classroom are described to illustrate the newly emerging options for differentiating instruction.