

Multiple Intelligences and Learning Styles: Two Complementary Dimensions

STEPHEN J. DENIG

Niagara University

This paper compares the theories of multiple intelligences and learning styles to suggest ways that teachers using a combination of both theories may be able to improve student learning over the range of intelligences. The author proposes a research format for the benefit of future research.

Almost every teacher today has heard the terms *multiple intelligences* and *learning styles*. However, how many teachers know the definition of an intelligence and know the number of distinct intelligences? In addition, how many teachers could define what we mean by learning style and identify the distinct elements of learning styles? Some, perhaps, but not all, would know this. This article focuses on the eight multiple intelligences identified by Howard Gardner and the 21 elements of learning style identified by Kenneth and Rita Dunn. This selection is not meant to imply that Gardner's and the Dunns' approaches are the only understandings of the complex issues of human intelligence and learning.

Are multiple intelligences and learning styles simply two different names and two different enumerations of the same thing? Are they similar, or are they distinct? In a previous paper (Dunn, Denig, & Lovelace, 2001), the similarities and differences between these two concepts were examined, and it was proposed that, while distinct, they are not competing concepts, and they work together to contribute to learning.

This article examines these two concepts to conceptualize how they can work together to contribute to learning. I conclude with several future areas of research. First, however, the two concepts need to be explained.

GENERAL INTELLIGENCE

The modern study of intelligence can be traced to Alfred Binet, whose research was conducted at the end of the 19th century and the beginning of the 20th century. This was the time that the study of psychology moved away from prescientific understandings to more empirical investigations

(Corno et al., 2002). Binet, collaborating with Theodore Simon, believed that intelligence was measurable (Binet & Simon, 1905). They proposed a series of questions that could be quickly administered and scored. The higher a person scored, it was assumed, the more intelligent the person. The strength of this test was that large groups of people could be tested at minimal cost and the more intelligent among them identified. For example, during World War I, many men were drafted, and there was a need to identify quickly the more intelligent men, so they could be trained as officers. The test had practical use and was economic and efficient. Two weaknesses of this test were that all of the questions were directly related to either mathematics or language skills, thus measuring intelligence by only these two domains, and the entire test was analytic, a processing style inhibiting the ease with which global people could respond (Brennan, 1984). Anyone who has taken the SAT or the ACT exams as the rite of passage to college knows how persistent the dominance of these two domains is in conceptualizing intelligence. These two domains often are expressed in a single score, which is meant to be a measure of general intelligence.

MULTIPLE INTELLIGENCES

Corno et al. (2002) note that the construct of a single overarching general ability is widely accepted. They report that today there are approximately 120 different measures of general ability. Yet they also acknowledge that not all scholars are in agreement, and they cite in particular the work of Howard Gardner and Robert Sternberg.

Both Gardner and Sternberg advocate that intelligence should not be reduced to a single overarching construct. Gardner (1983) first identified seven distinct intelligences. Today, he (Gardner, 1999) identifies an eighth intelligence. Sternberg (1998) argues that that people possess three independent abilities: analytic (judging, comparing, contrasting, etc.), creative (inventing, discovering, imaging, etc.), and practical (applying, implementing, using, etc.). The focus in this article is on Gardner's multiple intelligences.

Howard Gardner advocates that there are at least eight intelligences that need to be considered (Nelson, 1998):

- Linguistic: the potential to use language, as used in reading, writing, telling stories, memorizing dates, and thinking in words
- Logical-mathematical: the potential for understanding cause and effect and for manipulating numbers, quantities, and operations, as used in math, reasoning, logic, problem solving, and recognizing patterns

- **Spatial:** the potential for representing the spatial world internally in one's mind as used in reading maps and charts, drawing, solving mazes and puzzles, imagining and visualizing
- **Kinesthetic:** the potential for using one's whole body or parts of the body, as used in athletics, dancing, acting, crafting, and using tools
- **Musical:** the potential for thinking in music; for hearing, recognizing, and remembering patterns, as used in singing, identifying sounds, and in remembering melodies and rhythms
- **Interpersonal:** the potential for working with others, as used in understanding people, leading and organizing others, communicating, resolving conflicts, and selling
- **Intrapersonal:** the potential for understanding ourselves, as used in understanding self, recognizing one's own strengths and weaknesses, and setting personal goals
- **Naturalistic:** the potential for discriminating among plants, animals, rocks, and the world around us, as used in understanding nature, making distinctions, identifying flora and fauna

Intelligence is more than a score on a typical standardized pencil-and-paper test used to predict success in school. Such traditional intelligence tests do not measure the ability of a chess player, an athlete, or a master violinist. Gardner (1999) opines that these individuals, as well as many others, exhibit intelligences that are not measured by these tests. He defines an intelligence as "biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (pp. 33–34).

For a potential to be identified as an intelligence it must meet eight criteria:

1. It must be rooted in the brain, so that an injury to the brain could rob a person of that specific potential (e.g., a blow to the head causing loss of linguistic ability).
2. It must be rooted in our evolutionary history, such that our early ancestors exhibited that potential (e.g., early humans had the naturalistic ability to discriminate among the different species of plants).
3. There has to be an identifiable core operation or set of operations associated with that potential (e.g., pitch, rhythm, etc. are core operations of musical ability).
4. It must be susceptible to being encoded in symbol (e.g., mathematical symbols).

5. It must possess a distinctive developmental path to become expert in that ability (e.g., trained clinicians with strong interpersonal skills).

6. It is exemplified by the existence of idiot savants, prodigies, and other exceptional people (e.g., Rainman's mathematical ability).

7. There is evidence from experimental psychology that the ability is distinct from other abilities (e.g., a person can walk and talk at the same time because the two abilities evidence different abilities—linguistic and kinesthetic).

8. It is supported by psychometric findings (e.g., a major league athlete might score high in ability hit a ball but low in the ability to hit a note).

Gardner (1999) has considered adding either existential or spiritual intelligence as a ninth intelligence but has not yet done so. He sees that the existential and the spiritual are similar, with existential being more narrowly defined and spiritual being more broadly defined. He concludes (p. 64) that the existential, as narrowly defined, might fit the previous criteria for an intelligence, but spiritual does not. Because he has not yet affirmed that existential is a ninth intelligence, it is not considered as one on the intelligences in this article.

As may be suggested by the previous criteria, the theory of multiple intelligences emerged from previous psychological studies. However, it must be noted that none of those previous investigations were involved with Gardner's construct of multiple intelligences. Gardner has been totally honest and forthright about the lack of experimental research on his theory. He notes, "While Multiple Intelligences theory is consistent with much empirical evidence, it has not been subjected to strong experimental tests. . . . Within the area of education, the applications of the theory are currently being examined in many projects. Our hunches will have to be revised many times in light of actual classroom experience" (Gardner, 1993, p. 33).

Nevertheless, even without the existence of a strong research base, there is much popular support for the concept of multiple intelligences. Some strengths of the theory in relationship to the learning process are as follows:

- It serves as impetus of reform in our schools, "leading to a re-evaluation of those subjects typically taught in school, with increased emphasis placed on the arts, nature, physical culture, and other topics traditionally limited to the periphery of the curriculum" (Armstrong, 2003, p. 4).

- It is child centered and develops children's innate potential rather than requiring them to master extraneous academic information.
- It encourages children to grow and to develop their potential as responsible human beings.
- It challenges educators to find "ways that will work for this student learning this topic" (Gardner, 1999, p. 154).

As Gardner (1999) has written:

I would happily send my children to a school that takes differences among children seriously, that shares knowledge among differences with children and parents, that encourages children to assume responsibility for their own learning, and that presents materials in such a way that each child has the maximum opportunity to master those materials and to show others and themselves what they have learned and understood. (pp. 91–92)

LEARNING STYLES

There are many different advocates of learning styles, and they propose different constructs. Snow, Corno, and Jackson (1996) summarize the work of four theorists or groups of theorists. Keefe measures learning styles in terms of cognitive skills and instructional preferences. Pintrich Smith and others opine that value components, expectancy components, affective components, cognitive strategies, and resource management combine to form the construct of learning style. Researchers led by Schmeck measure learning styles in terms of academic self-concept, reflective processing, agentic processing, and methodical study. Finally, Weinstein and colleagues combine 10 dimensions in the measure of learning styles: anxiety, attitude, concentration, information processing, scheduling, selective main ideas, self-testing, study aids, and test strategies.

This article focuses on the construct of learning styles proposed by Rita and Kenneth Dunn. As is noted later, researchers at over 120 universities have explored this construct at every level of education from pre-K to graduate school. I focus on this particular construct because I seek to build on this extensive research record to investigate empirically the synthesis of multiple intelligences and learning styles.

The Duns opine that people are not necessarily intelligent because they have a potential, talent, or innate ability. Rather, people can demonstrate intelligence because of the manner in which they perceive, comprehend, adapt to new situations, learn from experience, seize the essential factors of a complex matter, demonstrate mastery over complexity, solve problems,

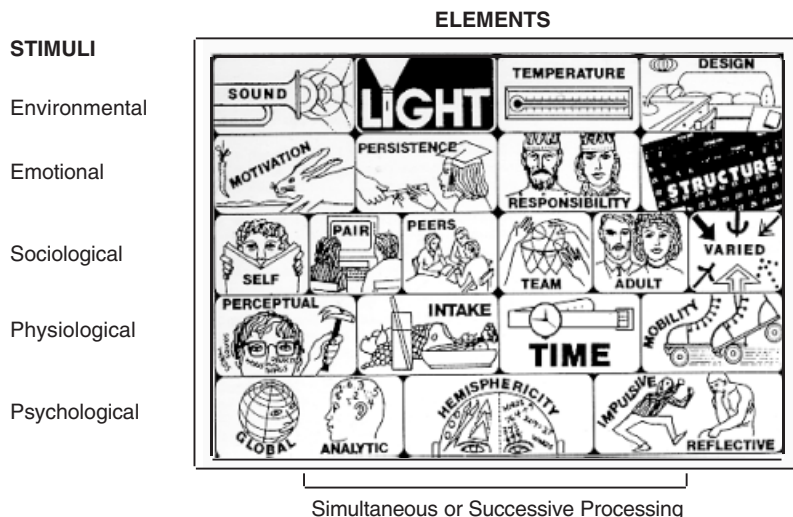


Figure 1. Dunn and Dunn Learning Styles Model (Dunn & Dunn, 1993)

critically analyze, and make productive decisions. They remind us that human beings are not necessarily intelligent because they have potential or talent; we all know some who have wasted or damaged both their potential and their talent because they did not think intelligently (Denig & Lovelace, 1999).

As noted previously, Gardner defines an intelligence as “as biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture” (Gardner, 1999, pp. 33–34). The Dunns (1993, 1999) define *learning style* as the way in which each person begins to concentrate on, process, internalize, and remember new and difficult academic content. Their model addresses 21 unique elements. Although no one is influenced by all 21 elements, most students are affected by 6 to 14. Those 21 elements are classified into environmental, emotional, sociological, physiological, and psychological variables (see Figure 1).

- **Environmental:** This variable is composed of four elements: sound, light, temperature, and design.
 - **Sound:** Some learners require absolute quiet to learn, while others do best with music or other sound in the background.
 - **Light:** Some learners require bright learning to concentrate, whereas others require a softer and perhaps more focused light.

- Temperature: Some learners require warmth, whereas others require a cooler environment, while concentrating on new and difficult academic knowledge or skills.
- Design: Some prefer more formal seating (e.g., hard chairs), whereas others prefer casual, informal seating (e.g., sofa).
- Emotional: This variable is also composed of four elements:
 - Motivation: Some learners are eager to begin learning something new or difficult, whereas others need to be challenged by someone else to begin.
 - Persistent: Some learners remain focused on an academic task until it has been completed, whereas others need to be reminded to complete the task at hand.
 - Responsibility: Some do what is required, whereas others do the opposite of what they are supposed to do (conformists vs. nonconformists).
 - Structure: Some rely on the directives of teachers or peers to provide structure to a task, whereas others determine their own structure for completing a task.
- Sociological: This variable is composed of six elements:
 - Self: 13 percent of students (often our gifted) perform best when studying alone (Dunn & Griggs, 2003).
 - Pair: Some prefer to study in pairs with a peer.
 - Peers: Some (less than one third) prefer to study with a group of peers (Dunn & Griggs, 2003).
 - Team: Some prefer to study with a large group of peers.
 - Adult: Some (about 28%) prefer to work with an adult (Dunn & Griggs, 2003).
 - Varied: Some function in varied ways, whereas others learn best in a single pattern.
- Physiological: This variable is composed of four elements:
 - Perceptual: Some students learn best by hearing (auditory) complex material, others by reading or seeing it (visual), others when able to manipulate items with their hands (tactual, as when doodling or taking notes), and still others learn most effectively when moving while they are concentrating (kinesthetically, such as tapping their feet or walking).

- **Intake:** Some learners require a drink or something to eat; others ignore drink and food when concentrating on new and difficult material.
- **Time:** Some prefer to concentrate in the morning, others in the early or late afternoon, and some prefer the evening.
- **Mobility:** Some sit and concentrate for long periods of time without much movement; others require the ability to move about.
- **Psychological:** This variable is composed of three elements:
 - **Global-analytic processors:** Global processors learn best through an initial overview of the content or concept to develop an understanding of how the content relates to them before they can focus on the facts related to it. They then focus on the related facts. Analytics learn facts in a step-by-step sequence, gradually building to increased understandings by first examining the facts and then building toward an understanding of the concept (Dunn & Griggs, 2003).
 - **Hemisphericity:** some learners tend to employ a right side of the brain style, whereas others use a left-side pattern when concentrating on new information.
 - **Impulsive-reflective:** Some learners reach conclusions by going through a thorough process, whereas others reach conclusion quickly and have little fear of failure (being wrong).

Each learner has a primary learning style, and can be taught how to study and concentrate capitalizing on that style. Dunn and Dunn (1993; Dunn & Griggs, 2003) propose a variety of study methods that learners can adapt to capitalize on that strength (e.g., Contract Activity Packages for the nonconforming and the high achievers who are motivated and auditory or visual, Programmed Learning Sequences for those who need external structure and who are visual and tactual, Tactual Resources, and Kinesthetic Resources, small-group strategies for the peer oriented, and Multisensory Instructional Packages for students who require varied types of reinforcement). Figure 2 outlines some of these strategies.

However, most learners also have a secondary style, which can be used to reinforce initial learning effectively. In addition, educators should vary their teaching style to accommodate their students' varied styles. Although without prior knowledge, many teachers cannot perceive how to respond to the learning styles of 20 or more individuals with different styles in the same class simultaneously, hundreds of schools or school districts internationally have established successful learning style programs in which students achieve statistically higher standardized achievement test scores within

Alternative Methods	Responding to	
	Learning Style Elements	Other Student Characteristics
Contract Activity Package	Environmental preferences Sociological preferences Perceptual strengths Physiological preferences Persistence Motivation Structure Analytic processing style	Self-pacing Independence Non-conformist Creativity
Programmed Learning Sequence	Persistence Sociological preferences Environmental preferences Physiological preferences Structure Visual/Tactual strengths Global processing style	Self-aping Variety Reading difficulties Need for feedback
Tactual Resources	Tactual perceptual strength Environmental preferences Physiological preferences	
Kinesthetic Resources	Kinesthetic perceptual strength Environmental preferences Physiological preferences	

Figure 2. Alternative Methods Responsive to Students' Different Learning Styles (compiled by Rita Dunn and Andrea Honigsfeld; cf. Dunn, Denig, & Lovelace, 2001)

1 year of learning style implementation (Dunn & DeBello, 1999; Dunn & Griggs, 2003). Regardless of skepticism, students learn more effectively when educators teach in a manner consistent with each student's primary and secondary learning style (Dunn & Griggs, 2003).

A person's learning style is determined through a variety of age-appropriate instruments (see www.learningstyles.net; a computer version is also available, see Hurley, 2000). Dunn, Griggs, Olson, Gorman, and Beasley (1995) conducted a meta-analysis of 42 experimental studies conducted across the United States at 13 different universities during the 1980s. That analysis revealed that students' learning style preferences were

the strengths that enabled them to master new and difficult information, regardless of the researcher, the university where the research had been conducted, the students' grade level, or the element(s) examined. The overall, unweighted, group effect size value (r) was .384 and the weighted effect size value was .353 with a mean difference (d) of .755. Referring to the standard normal curve, this suggested that students whose learning styles were accommodated would be expected to achieve 75% of a standard deviation higher than students who had not had their learning styles accommodated. This indicated that matching students' learning style preferences with educational interventions compatible with those preferences was beneficial to their academic achievement.

A second meta-analysis of 76 experimental studies conducted at multiple universities with the Dunn and Dunn model was completed by Lovelace (2002). The total sample size (N) was 7,196 and the total number of individual effect sizes was 168. Twenty-one dissertations came from 17 universities other than the one at which this meta-analysis was conducted; four dissertations were done at the same university. The overall data reported significantly higher test scores when the Dunns' learning style strategies were employed and compared with traditional teaching, regardless of the university at which the study was conducted. Most effect sizes were medium to large dependent on the elements tested. Very few effect sizes were small, but some elements affect students more than others do.

Studies have been conducted at more than 120 institutions of higher education with a variety of model-related instructional approaches at every level. Most research has concentrated on the K-12 levels. However, research has been conducted on infants and on adults as diverse as law students (Russo, 2002), nurses (O'Hare, 2002), and teachers (Rowan, 1988). Those data documented that when academic underachievers were taught new and difficult (for them) content through instructional approaches that responded to their learning style strengths, they achieved statistically higher standardized achievement test scores than they did when the approach was dissonant from their style (Dunn & DeBello, 1999; *Research*, 2000).

Practitioners throughout the United States have reported statistically higher standardized achievement and attitude test scores after implementing the Dunn and Dunn model. Those gains were documented for poorly achieving and special education students in urban, suburban, and rural schools (Andrews, 1990; Brunner & Majewski, 1990; Dunn & DeBello, 1999; Elliot, 1991; Gadwa & Griggs, 1985; Geiser et al., 1999; Klavas, 1993; Koshuta & Koshuta 1993; Lemmon, 1986; Mickler & Zippert, 1987; Neely & Alm, 1992, 1993; Nelson et al., 1993; Orsak, 1990; Quinn, 1993; Stone, 1992).

Also, research indicates that several of the learning style elements are correlated with one another. Strongly analytic learners often tend to prefer concentrating in brightly illuminated, quiet, formal seating without breaks

or snacks, whereas strongly global learners often tend to prefer concentrating in a softly lit, casual (informal) environment with music, periodic breaks, and snacks (Dunn, Bruno, Sklar, & Beaudry, 1990; Dunn, Cavanaugh, Eberle, & Zenhausern, 1982).

DIFFERENCES BETWEEN THE MODELS

Although both Gardner and the Dunns challenge educators to change the manner in which they teach, the two advocated models differ in that Gardner stresses the need to change instruction to capitalize on students' abilities, whereas the Dunns suggest changing instruction to capitalize on students' learning styles. That is, multiple intelligences addresses what is taught (the product); learning styles addresses how it is taught (the process). Learning styles research has evidenced that any content can be mastered when taught through students' strengths.

Gardner stated that students learn intuitively. Learning style practitioners have found that some students are intuitive; many others are not and require structure and supervision. Multiple intelligences proponents advocate making changes in the methodology used in the classroom, but most emphasize using students' talents in the same way, at the same time, and in the same amount of time. Learning style proponents agree that the delivery system needs to be changed. However, because analytics learn differently from globals, and auditory, visual, tactual, and kinesthetic students each begin, reinforce, and retain what they have learned through different perceptual strengths, learning style advocates counsel teachers to use different instructional resources in a different sequence in accord with how each learns best.

Both multiple intelligences and learning styles discuss kinesthetic learners. However, multiple intelligences does not differentiate between kinesthetic and tactual learners. Learning style proponents, on the other hand, do differentiate between the two and advocate teaching them differently. Kinesthetic learners are those students who learn through whole-body activities and experiences, and tactual learners are those students who learn well with their hands.

Finally, as noted previously, there is little experimental research on multiple intelligences, whereas there is a strong research base evidenced for learning styles. This in no way suggests that one is better than the other. Rather, the purpose of this article is to propose that if we examine multiple intelligences and learning styles as different and complementary, we may be able to create a research base that demonstrates an increase in student learning across the whole spectrum of intelligences, including standardized achievement tests.

A PROPOSED SYNTHESIS

Gardner (1993) opined that “each intelligence may require its own specific educational theory” (p. 48). I propose that a synthesis of multiple intelligences with learning styles will be helpful in discerning the “specific educational theory” required by each intelligence. This proposal builds on the insight of Nelson (1998), who proposed that people who are smart in an intelligence learn best through methods associated with that intelligence:

- Verbal-linguistic learn best through reading, hearing, and seeing words and speaking, writing, discussing, and debating ideas.
- Math-logical learn best through working with patterns and relationships, classifying and categorizing, and working with the abstract.
- Spatial learn best in working with pictures and colors, visualizing and using the mind’s eye, and drawing.
- Bodily-kinesthetic learn best touching, moving, and processing knowledge through bodily sensation.
- Musical learn best with rhythm and melody, singing, and listening to music and melodies.
- Interpersonal learn best through sharing, comparing and relating with others, interviewing, and cooperating.
- Intrapersonal learn best through working alone, doing self-paced projects, and reflecting.
- Naturalists learn best when working in nature, exploring living things, and learning about plants and natural events.

Some of these methods by which people who are strong in a multiple intelligence learn best are suggestive of the various learning styles, by which learners process new and difficult information. Howard Gardner insists that people can develop, in varying degrees, each of the eight intelligences. Rita and Kenneth Dunn remind educators that students will learn best when they are taught and when they learn in a manner consistent with their primary and secondary learning styles.

What I propose is that multiple intelligences and learning styles form two dimensions graphically represented by a grid (cf. Figure 3). The eight multiple intelligences form the horizontal axis of the grid, and the 21 learning styles elements form the vertical axis. Are there correlations between the multiple intelligences and the elements of learning styles that can help people to develop all eight intelligences? This research can be approached in several ways.

	Verbal- Linguistic	Math Logic	Spatial	Bodily- Kinesthetic	Musical	Interpersonal	Intrapersonal	Naturalist
Sound								
Light								
Temperature								
Design								
Motivation								
Persistence								
Responsibility								
Structure								
Self								
Pairs								
Peers								
Teams								
Adult								
Varied								
Perceptual								
Intake								
Time								
Mobility								
Global-Analytic								
Hemisphericity								
Impulsive-Reflective								

Figure 3. Proposed Synthesis of Multiple Intelligence and Learning Styles

First, Nelson (1998) identified for each multiple intelligence several people who exhibit smarts in that intelligence. For example, she suggested Maya Angelou as exhibiting strong verbal-linguistic; Pablo Picasso, strong spatial; and Charles Darwin, strong naturalist. Teachers could identify students in their schools who exhibit a strong intelligence and use the Productivity Environment Preference Survey to determine their learning styles. A simple correlation could be run with the data to see which learning style elements correlate with each intelligence. If several correlations are found, a multiple regression could be run to determine which elements are the best predictors of an intelligence. This would be exploratory.

Second, confirmatory research should be done. In a study of approximately 6,000 students in nine cultures, Milgram, Dunn, and Price (1993) identified which learning style elements appeared to be characteristic of adolescents who exhibited a certain intelligence. For example, students who were gifted mathematically appeared to have essentially similar learning styles across nations. Their styles, however, were different from students who were gifted in art, music, or athletics—whose styles also were essentially similar across nations. Do students who are bodily kinesthetic have a preference for mobility? Not necessarily. Do people who are musical have a stronger auditory perceptual strength than visual? Neither. Interestingly, students who are musically inclined tend to be kinesthetic: They feel the music and rhythms (Kreitner, 1981). Since music is highly structured, do they exhibit a strong preference for structure? Would people who are interpersonal exhibit a stronger preference for learning in pairs, with peers, in groups, than people who are intrapersonal?

Or, because many intrapersonal people tend to place themselves under the guidance of a trained mentor, do they exhibit a strong adult (expert) orientation? Finally, would naturalist exhibit strong global strength because they must first see the balance of nature before they see the different places of animals and plants? Teachers would again identify students who exhibit a strong intelligence. Having proposed different correlations, shouldn't we test the learning style of each person and determine if the data confirms or denies the proposed correlation?

People are different and they have different combinations of intelligences. All of the intelligences are important. Gardner (1993) stated, "If we can mobilize the full range of human intelligences and ally them to an ethical sense, we can help to increase the likelihood of our survival on this planet, and perhaps even contribute to our thriving" (p. 12). If correlations are found, then the research would suggest that by using a variety of teaching styles that are sensitive to the learning styles of students, then Howard Gardner's dream might be fulfilled.

References

- Andrews, R. H. (1990). The development of a learning styles program in a low socioeconomic, underachieving North Carolina elementary school. *Journal of Reading, Writing, and Learning Disabilities International*, 6, 307-314.
- Armstrong, T. (2003). *The multiple intelligences of reading and writing: Making the words come alive*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Binet, A., & Simon, T. (1905). Méthodes nouvelles pour le diagnostic du niveau intellectuel des anormaux [New methods for the diagnosis of the intellectual level of the abnormal]. *L'année psychologique*, 11, 236-245.
- Brennan, P. K. (1984). An analysis of the relationships among hemispheric preference and analytic/global cognitive style, two elements of learning style, method of instruction, gender, and mathematics achievement of tenth-grade geometry students (Doctoral dissertation, St. John's University, 1985). *Dissertation Abstracts International*, 45(11), 3271A.
- Brunner, C. E., & Majewski, W. S. (1990). Mildly handicapped students can succeed with learning styles. *Educational Leadership*, 48(2), 21-23.
- Corno, L., Cronback, L. J., Kupermintz, H., Lohman, D. F., Mandinach, E. B., Porteus, A. W., & Talbert, J. (2002). *Remaking the concept of aptitude: Extending the legacy of Richard E. Snow*. Mahwah, NJ: Erlbaum.
- Dunn, R., Bruno, J., Sklar, R. I., & Beaudry, J. S. (1990). Effects of matching and mismatching minority developmental college students' hemispheric preferences on mathematics scores. *Journal of Educational Research*, 83, 283-288.
- Dunn, R., Cavanaugh, D., Eberle, B., & Zenhausern, R. (1982). Hemispheric preference: The newest element of learning style. *The American Biology Teacher*, 44, 291-294.
- Dunn, R. & DeBello, T. C. (Eds.). (1999). *Improved test scores, attitudes, and behaviors in America's schools: Supervisors' success stories*. Westport, CT: Bergin & Garvey.
- Dunn, R., Denig, S., & Lovelace, M. (2001). Multiple intelligences and learning styles: Two sides of the same coin or different strokes for different folks. *Teacher Librarian: The Journal for School Library Professionals*, 28(3), 9-15.

- Dunn, R., & Dunn, K. (1993). *Teaching secondary students through their individual learning styles*. Boston: Allyn & Bacon.
- Dunn, R., & Dunn, K. (1999). *The complete guide to the learning styles inservice system*. Boston: Allyn & Bacon.
- Dunn, R., & Griggs, S. A. (2003). *Synthesis of the Dunn and Dunn learning-style model research: Who, what, when, where, and so what?* New York: St. John's University's Center for the Study of Learning and Teaching Styles.
- Dunn, R., Griggs, S. A., Olson, J., Gorman, B., & Beasley, M. (1995). A meta-analytic validation of the Dunn and Dunn model of learning-style preferences. *Journal of Educational Research, 88*, 353–361.
- Elliot, I. (1991). The reading place. *Teaching K-8, 21*(3), 30–34.
- Gadwa, K., & Griggs, S. A. (1985). The school dropout: Implications for counselors. *School Counselor, 33*(1), 9–17.
- Gardner, H. (1983). *Frames of Mind: The theory of multiple intelligences*. New York: Basic Books.
- Gardner, H. (1993). *Multiple intelligences: The theory into practice*. New York: Basic Books.
- Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century*. New York: Basic Books.
- Geiser, W. F., Dunn, R., Deckinger, E. L., Denig, S., Sklar, R., & Beasley, M. (2000). Effects of learning-style awareness and responsive study strategies on achievement, incidence of study, and attitudes of suburban eighth-grade students. *National Forum of Applied Educational Research, 13*(2), 37–49.
- Hurley, E. K. (2000). Comparative reliability and validity of two text-oriented learning-style diagnostic instruments and the CD-ROM version of *Our Wonderful Learning Styles* (Doctoral dissertation, St. John's University). *Dissertation Abstract International, 61*(09), 3530A.
- Klavas, A. (1994). In Greensboro, North Carolina: Learning style program boosts achievement and test scores. *The Clearing House, 67*, 149–151.
- Koshuta, V., & Koshuta, P. (1993). Learning styles in a one-room school. *Educational Leadership, 50*(7), 87.
- Kreitner, K. R. (1981). *Modality strengths and learning styles of musically talented high-school students* (Unpublished master's thesis, Ohio State University, Columbus).
- Lemmon, P. (1985). A school where learning styles make a difference. *Principal, 64*(4), 26–28.
- Lovelace, M. A. K. (2002). A meta-analysis of the Dunns' model of learning styles. (Doctoral dissertation, St. John's University). *Dissertation Abstract International, 63*(06), 2114A.
- Mickler, M. L., & Zippert, C. P. (1987). Teaching strategies based on learning styles of adult students. *Community/Junior College Quarterly of Research and Practice, 11*(1), 33–37.
- Milgram, R., Dunn, R., & Price, G. E. (Eds.). (1993). *Teaching and counseling gifted and talented adolescents: An international learning style perspective*. New York: Praeger.
- Neely, R., & Alm, D. (1992). Meeting individual needs: A learning styles success story. *The Clearing House, 66*, 109–113.
- Neely, R., & Alm, D. (1993). Empowering students with style. *Principal, 72*(4), 32–35.
- Nelson, B., Dunn, R., Griggs, S. A., Primavera, L., Fitzpatrick, M., Baciliou, Z., & Miller, R. (1993). Effects of learning style intervention on students' retention and achievement. *Journal of College Student Development, 34*, 364–369.
- Nelson, K. (1998). *Developing students' multiple intelligences*. New York: Scholastic.
- O'Hare, L. (2002). *Effects of traditional versus learning-style presentations of course content in adult health nursing on the achievement and attitudes of baccalaureate nursing students* (Doctoral dissertation, St. John's University).
- Orsak, L. (1990). Learning styles versus the Rip Van Winkle syndrome. *Educational Leadership, 48*(2), 19–20.
- Quinn, R. (1993). The New York State compact for learning and learning styles. *Learning Styles Network Newsletter, 15*(1), 1–2.

- Research on the Dunn and Dunn Model.* (2000). New York: St. John's University's Center for the Study of Learning and Teaching Styles.
- Rowan, K. S. (1988). Learning styles and teacher in-service education (Doctoral dissertation, University of Tennessee, 1984). *Dissertation Abstracts International*, 50(02), 418A.
- Russo, K. (2002). Teaching law students: An innovative approach. *Academic Exchange Quarterly*, 6(4), 151–159.
- Snow, R. E., Corno, L., & Jackson, D. (1996). Individual differences in affective and conative functions. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 243–310). New York: Simon & Schuster.
- Sternberg, R. J. (1998). Applying the triarchic theory of human intelligence in the classroom. In R. J. Sternberg & W. M. Williams (Eds.), *Intelligence, instruction, and assessment*. (pp. 167–181). Mahwah, NJ: Erlbaum.
- Stone, P. (1992). How we turned around a problem school. *Principal*, 71(2), 34–36.