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Learning Styles Applied: Harnessing Students' Instructional Style Preferences

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Current literature on the topic of *styles* as they pertain to learning and instruction testifies to the wide range of interpretations of the construct. Various models address personality traits, information-processing preferences, decision-making approaches, and a broad array of additional understandings and conceptions. The terminology relating to these theories is also diverse, including the labels *learning styles, cognitive styles, thinking styles*, and more. As there are no agreed-on definitions of these terms, we will refer to theories by the terminology preferred by the authors we discuss in this chapter. We will use the term "styles" when speaking generally about theories in this body of literature.

In this chapter, we will explore various classification systems for organizing the styles literature, as well as some of the more influential theories in the field. Then we will look at research addressing attempts to match learning experiences to various student styles. Finally, we will present a theory that is concerned with what might be called applicative styles—that is, the issue of how styles are manifested in the classroom. Specifically, this model addresses students' preferences for various instructional techniques. These techniques range from direct instruction to independent study and include methods such as simulations and peer teaching. By encouraging researchers and educators to consider the issue of students' instructional style preferences, we hope to increase engagement, efficiency, and enjoyment in learning.

Classification Systems and Influential Theories

As noted, styles theories abound, each with different constructs and many with different instruments for the measurement of those constructs. Inevitably, researchers seeking to create order out of chaos have created systems to categorize this literature. In this section, we will address some of these systems, as well as some of the prominent style theories they attempt to classify.

Cognitive Styles and Learning Styles

One of the most basic approaches to classifying literature on styles distinguishes between cognitive theories and learning theories (Cassidy, 2004; Desmedt & Valcke, 2004; Rayner & Riding, 1997; Riding & Cheema, 1991). As previously noted, there are no universally agreed-on definitions of these terms. Nonetheless, this was a distinction preferred by Rayner and Riding (1997), who argued that cognitive style research and learning style research represent divergent traditions. They noted that the former dates to the 1930s, with the latter entering the scene in the 1970s. Cassidy (2004) likewise discussed the broad categories of cognitive style versus learning style and suggested that cognitive preferences may be a component of learning preferences.

A recent citation analysis (Desmedt & Valcke, 2004) of the literature on styles supported the idea that learning style research and cognitive style research represent two distinct traditions.

Using the keywords “cognitive style” and “learning style,” Desmedt and Valcke searched the Institute for Scientific Information’s Social Science Citation Index, dating back to 1972. In the more than 1,000 articles located by the search, Desmedt and Valcke found that researchers were consistently identified either as learning style theorists or as cognitive style theorists. Moreover, they found almost no academic collaboration between those studying cognitive styles and those studying learning styles. Of the 49 most-cited authors across the learning styles and cognitive styles literature, only 4 contributed significantly to both spheres of inquiry (Desmedt & Valcke, 2004).

Among cognitive style researchers, Witkin (1972) was the most cited, with 39% of literature in this category referencing his field-independence/ dependence theory. Witkin proposed that field-dependent people rely heavily on visual context when perceiving and interpreting information. In contrast, field-independent people are able to perceive and interpret information with relative accuracy regardless of visual context. By analyzing co-citation among authors in the cognitive styles literature, Desmedt and Valcke (2004) found that not only was Witkin highly cited, but he was also central to the largest of six clusters of researchers who collaborated and influenced each other in the cognitive styles field. Other theorists in this dominant cluster included Kagan (1966), who explored what he called *conceptual tempo*—the idea that individuals are either reflective or impulsive in their decision-making styles. Goodenough (1976) and Oltman (1975) also belonged in this cluster, investigating the impact of field-independence/dependence on learning and memory (Desmedt & Valcke, 2004). While some of the authors in this cluster presented unique cognitive style models, Desmedt and Valcke suggested that they were bonded by a common focus on information processing and perception. Desmedt and Valcke also noted that a substantial number of the authors citing Witkin shared a theoretical position that cognitive styles were relatively stable modes of perceiving and organizing information. In other words, this group of researchers saw cognitive styles as more traitlike than statelike.

Returning to Desmedt and Valcke’s (2004) analysis, Kolb (Kolb, 1999; Kolb & Kolb, 2005) was the most cited author in the learning styles camp, with 49% of articles using the keywords “learning styles” referencing his work Kolb has been best known for his experiential learning theory (ELT), in which he suggested that learning was constructed through an exchange between an individual and the environment. Learning styles in this model were proposed as the outcome of two different modes of experiencing the world (concrete experiential and abstract conceptualization) and two different modes of grasping information (reflective observation and active experimentation). The interactions of these two dimensions resulted in four different learning styles, which Kolb identified as diverging, assimilating, converging, and accommodating.

Just as Witkin (1972) was central to the largest cognitive styles cluster, Kolb (Kolb, 1999; Kolb & Kolb, 2005) was central to the largest cluster of mutually referencing authors in the learning styles literature (Desmedt & Valcke, 2004). This cluster included Dunn (Dunn & Dunn, 1978), Myers (1962), Witkin, and Curry (1983, 1990), among others. Desmedt and Valcke suggested that many of the researchers in this cluster generally championed the ideas that learning styles are relatively fixed individual differences, that no one learning style is superior to any other, and that schools must take learning styles into account to maximize student performance (Desmedt & Valcke, 2004). The work of Dunn (Dunn & Dunn, 1978) was provided as an example of this orientation. Dunn and Dunn have been credited with adapting Kalb’s work with adults to meet the needs of children in the classroom (Desmedt & Valcke, 2004). Myers

(1962), who built on the work of Jung and identified 16 personality types, was another prominent researcher in this group.

Wholist-Analytic and Verbalizer-Imager Styles

Riding and Cheema (1991) argued that most style theories and models could be grouped into one of two style categories or, alternatively, labeled as "learning strategies." Riding and Cheema used the term "styles" to refer to relatively fixed, inborn characteristics (a traitlike interpretation), while the term "strategies" referred to malleable methods of tackling various tasks (a statelike interpretation). Riding and Cheema believed that unlike styles, strategies can be learned and can change over time or in response to task demands.

The first of Riding and Cheema's (1991) style categories was the wholist-analytic family of theories. Theories in this category address whether one tends to process information by taking in the big picture (wholist) or by adding up the parts (analytic). Interestingly, similarly to Desmedt and Valcke (2004). Riding and Cheema saw Witkin (1972) as the central theorist in this group of style researchers. Kagan (1966) was also included in this category, as were Pask and Scott (1972), who classified learners as serialists or holists. According to this theory, serialists learned by seeking specific data in a linear manner, while wholists looked for patterns in large quantities of data. Pask and Scott believed that despite this stylistic difference, serialists and holists were equally adept at learning.

Riding and Cheema's (1991) verbalizer/imager distinction referred to whether one preferred to mentally store and recall information as words or as pictures. Riding and Cheema saw Paivio (1971) as the central figure in this family of theorists. His Individual Difference Questionnaire (IDQ) was designed to measure individuals' habits as well as abilities in storing information. By exploring what people typically did as well as their strengths, Paivio (1971) was attempting to capture a fuller picture of storage and recall than other instruments available at that time (Paivio & Harshman, 1983). For example, in addition to a typical item probing a test-taker's ability to visualize moving objects, the IDQ included items such as "I often remember work I have studied by imagining the page on which it is written," and "I enjoy visual arts, such as paintings, more than reading" (Paivio & Harshman, 1983, p. 462).

Interestingly, Riding and Cheema (1991) labeled as learning strategies several prominent theories that others have seen as style theories. These included the Myers-Briggs Type Indicator (MBTI; Myers, 1962), and the work of Kolb (Kolb, 1984; Kolb & Kolb, 2005) and Dunn (Dunn & Dunn, 1978).

Intellectual Styles

Zhang and Sternberg (2005) proposed a *threefold model of intellectual styles*. In this categorization system, three types of styles were identified: Type I, Type II, and Type III. Zhang and Sternberg suggested that individuals with a preference for Type I intellectual styles prefer tasks with limited structure and high degrees of complexity, creativity, and freedom. They characterized Type II intellectual styles as a preference for tasks with a high degree of structure, well-established ways of doing things, and relatively shallow processing of information and ideas. Finally, they proposed that Type III styles comprise an amalgam of the previous two, with fluctuations in style depending on the task demands and the level of engagement on the part of the learner.

An interesting facet of this system is that rather than slotting style theories into various categories, Zhang and Sternberg (2005) fit concepts relating to each theory into a new organizational system. For example, Biggs (1987, 1999) proposed three types of approaches to learning: deep (learning for intrinsic purposes, reading broadly, and relating material to previously learned ideas), surface (doing the bare minimum and focusing on memorization and reproduction), and achieving (doing what is necessary to achieve regardless of interest level). In the threefold model of intellectual styles, Zhang and Sternberg characterized the deep learning approach as a Type I orientation, the surface approach as a Type II orientation, and the achieving approach as a Type III orientation. In the case of Gregorc's (Gregorc, 1984; Gregorc & Ward, 1977) learning modes, Zhang and Sternberg classified concrete random (a preference for intuitive, experimental, and independent learning) as a Type I style and concrete sequential {a preference for hands-on, linear, and structured learning) as a Type II style. Abstract random (a preference for reflective, unstructured, and wholistic learning) and abstract sequential (a preference for symbols and images, rational, and sequential learning) were classified as Type III styles.

In addition to classifying various well-known style theories using the threefold model, Zhang and Sternberg (2005) took an explicit stand on the issues of whether styles are states or traits and whether they are value-laden or value-free. According to Zhang and Sternberg, styles can be socialized and modified, and thus are more statelike than traitlike. They also suggested that style constructs are frequently value-laden. Specific examples provided by Zhang and Sternberg included Witkin's (1972) field-independence/dependence model and Kagan's (1966) reflective versus impulsive model. In both cases, the former is often considered superior to the latter, with research often implicitly supporting these positions.

For example, Witkin, Moore, Goodenough, and Cox (1977) described an unpublished study by Frances Harris in which participants were asked to create a shelf with two supports but were provided with only one nail and a pair of pliers. They noted that field-independent people were more likely than field-dependent people to see that the pliers could be used in a novel way as the second support for the shelf. Hansen and Stansfield (1981) found that field-independent foreign language learners in a Spanish class learned more effectively, as measured by achievement scores, than field-dependent learners. Rickards, Fajen, Sullivan, and Gillespie (1997) found that field-dependent, but not field-independent, learners benefited from signaling phrases when taking notes from a lecture. They hypothesized that these signal phrases acted like tags that helped field-dependent learners impose structure on the material they were hearing.

Zhang and Sternberg (2005) argued that not only is field-independence valued over field-dependence but that, in general, Type I styles are valued over Type II styles—although they noted that context plays a role in these judgments. In many societies, Type I characteristics such as creativity and an affinity for complexity have been seen as inherently superior to Type II characteristics such as concrete thinking and impulsive conceptual tempo.

If we accept these proposals, we are naturally led to consider how style-based value judgments may play out in schools. For example, in the United States, primary and elementary school classrooms often revolve around order, memorization, and regurgitation of facts. We do not know whether, in general, students favoring Type II or Type III styles perform better in these structured environments than those favoring Type I styles or whether it is possible that some young students favoring Type I styles may use their creativity to make necessary adaptations.

In the upper grades and in adult American society, complex thinking and creativity are highly valued. Nonetheless, the early career years of even the most creative people often involve routine tasks and limited opportunities for independent thinking. How individuals with various intellectual styles adapt to changing expectations and cognitive requirements across environments and the lifespan are interesting questions for future research. However, regardless of the direction of value judgments in style constructs, the association of judgment with various styles poses problems for democratic ideals of education, where various learning styles are often proposed to be different but equally valid.

Curry's Onion Model

One of the most comprehensive and well-known systems for classifying styles literature was that proposed by Curry (1983, 1990). Using the metaphor of an onion, Curry suggested that style theories fall into one of three categories or layers, each concerned with successively more central personality and information-processing characteristics.

Theories falling in the innermost layer of the style onion, according to Curry (1983), address "cognitive personality style" (p. 8). Qualities addressed by these theories are relatively permanent and underlie learning processes rather than interacting directly with the environment. Theories in this stratum, according to Curry, include Myers and Briggs' personality theory (Myers, 1962) and Witkin's (Witkin, 1972; Witkin et al., 1977) cognitive style research. The second layer of learning style research dealt with what Curry (1983) called "information processing style" (p. 11). She saw this layer as dealing with relatively stable learning preferences that none-the-less could be modified by instruction or strategies. Theories in this stratum dealt with individuals' tactics for assimilating information. Curry cited the work of Kolb (1984, 1999) as an example of a theory fitting into this stratum. The third, outermost layer of the onion was "instructional preference" (Curry, 1983, p. 8). She saw this as the most observable layer, the least stable, and the most interactive with environment, including teacher expectations. Instructional preference refers to learners' relative affinity for specific learning environments. We propose that the work done by Renzulli and colleagues (Renzulli & Smith, 1978; Renzulli, Smith, & Rizza, 2002) on instructional styles falls into this third tier of style theories.

Matching Instruction to Learning Styles

More than 25 years ago, Dunn, DeBello, Brennan, Krimsky, and Murrain (1981) declared, "We can no longer afford to assume that all students will learn through whichever strategy the teacher prefers to use (p. 372). For years, researchers have attempted to support this claim by exploring how teachers' presentation and assessment of information affect learners. Ruscio and Amabile (1999), for example, asked 82 college students to complete a structure-building task after receiving one of two types of video instruction. The first type of instruction explicitly taught building strategies in the context of creating a model that met the specifications of the experimental task. The second type of instruction also showed a model that met specifications but that demonstrated strategies heuristically. In this second video, instructors suggested loose groups of potentially helpful building strategies. Researchers found that the two groups were equally able to build structures meeting predetermined specifications. However, participants receiving step-by-step instruction were most successful when they closely copied the structure demonstrated during their instructional video. They were less successful when they tried to diverge from that model to build a novel structure using the techniques incorporated into the instructions. Participants in the heuristic instruction condition, on the other hand, were less successful when they tried to reproduce the structure in the video but more successful than participants in the step-by-step condition at producing novel structures that met building conditions. This type of research suggests that instructional styles do indeed affect students' learning outcomes in complex ways that are neither linear nor well-understood.

A more specific question, however, is whether matching instructional styles to individual students' learning styles improves academic outcomes or student attitudes toward their learning experiences. To date, findings have been mixed. Pettigrew, Bayless, Zakrajsek, and Goe-Karp (1985) found that strongly matching and strongly mismatching students and professors based on learning and teaching styles had no impact on students' ratings of professors. MacNeil (1980) tested two different instructional styles on field-dependent and field-independent students and found no differences in learning outcomes based on instruction or style. Cook, Gelula, Dupras, and Schwartz (2007) randomly assigned medical residents to Web-based courses that were either matched or mis-matched to their active or reflective learning styles, as defined by Kolb (1984). Researchers found no significant differences in learning gains between matched and mismatched students (Cook et al., 2007).

Ford and Chen (2001) had more promising results. They matched or mismatched instructional materials to postgraduate students based on their field-dependence or independence. Field-dependent students were considered matched to materials that provided breadth of information before depth of information. Field-independent students in matched conditions received materials that provided depth of information first. The proposed task was to build a Web page. Researchers found that matched students outperformed mismatched students on measures of conceptual knowledge gain. However, there were no significant differences between matched and mismatched students on a practical test of Web page design.

Riding and Douglas (1993) also had some success in matching students to conditions favoring their learning styles. They randomly assigned adolescents to one of two computer training modules designed to show how car brake systems work. In one condition, students received text-only computer instruction. In the other, they received text plus pictures. After completing training, participants were tested on their new knowledge. Their learning styles were then assessed on two dimensions: verbal-imagery and wholist-analytic. Researchers found that imagers outperformed verbalizers in the text-plus-pictures training conditions, while verbalizers outperformed imagers in the text-only condition, suggesting that in this case, matching had a positive impact on learning. In another study, Riding and Watts (1997) further tested the verbal-imagery/wholistic-analytic match by giving students three versions of a study-skills worksheet. One version provided information in paragraphs with headings (structured verbal). Another offered the information in paragraph form without headings (unstructured verbal). The third version offered information in paragraph form with pictures to illustrate the suggested study skills. Riding and Watts found that most verbalizers chose the structured verbal format, while most imagers chose the structured pictorial format. No students selected the unstructured verbal format. These results suggested that given choices, students would select materials that match their learning styles.

Finally, Dunn, Griggs, Olson, Beasley, and Gorman (1995) analyzed 36 studies of instruments designed to assess Dunn and Dunn's learning styles. The studies yielded a sample size of more than 3,181, with 65 different effect sizes. Findings suggested that the academic achievement of students whose learning styles were matched might be as much as three-quarters of a standard deviation higher than that of students whose learning styles were not matched. These findings were promising in light of criticisms suggesting that learning styles remained unproven as a construct affecting educational outcomes (Dunn et al., 1995).

A potential cause of the varied findings on learning styles and achievement is the complexity involved in attempting to ascertain how the psychological and cognitive qualities associated with various styles affect talent and affinity for instructional and learning practices. In other words, many style theories fall into the inner tiers of Curry's (1983) onion model, while instruction, by its very nature, lies in the outer tier. Thus, even when teachers make the effort to gather data about students' learning styles, they may not know how to modify instruction to best meet students' individual needs. Renzulli's work with instructional styles and the subsequent development of the Learning Style Inventory (LSI-III; Renzulli et al., 2002) was designed to overcome this hurdle by bypassing the psychological underpinnings of student preferences in favor of direct assessment of their preferred instructional styles and academic activities.

Preference-Based Learning and Renzulli's Learning Styles Inventory

The LSI-III (Renzulli et al., 2002) evolved from the idea that harnessing students' interests and preferences could lead to the highest levels of creative and academic excellence. This belief was formalized and operationalized in an educational theory called the enrichment triad model (Renzulli, 1977), which later gave rise to a more comprehensive and flexible educational model called the schoolwide enrichment triad model (SEM; Renzulli & Reis, 1985, 1994). Both the triad model and SEM are in use in schools today and were designed to provide students with high-end, interest-based learning opportunities, with the goal of greatly increasing students' interest, enjoyment, and achievement in learning.

The triad model laid the foundation for SEM by advocating a three-step process for engaging high-achieving or gifted students. Under the triad model, student interest is initially captured by exposure to a broad array of creative and educational experiences, labeled Type I experiences. These include field trips, plays, concerts, guest speakers, and other creative/educational exposure opportunities. Type II enrichment includes instructional methods and materials purposefully designed to promote the development of thinking, feeling, research, communication, and methodological processes. Type II activities are designed to build on Type I experiences, by allowing students who have demonstrated particular interest or talent in a given area to further explore the topic in a small group format. For example, students who demonstrate a particular interest in a presentation on pollution might work with an environmental scientist to learn more about pollution in their own region. Finally, Type III experiences are research or creative projects in which individual or small groups of students have the opportunity to act as practicing professionals in an area in which they have demonstrated substantial interest or achievement. An example of a Type III would be a sixth-grade student who, after expressing interest in literature and creative writing, undertook the task of writing and publishing a novel. Each type of enrichment is viewed as a component of a wholistic process that blends present or newly developed interests (Type I) and advanced-level thinking and research skills (Type II) with application situations based on the modus operandi of the first-hand inquirer (Type III).

SEM built on the triad model by making interest- and preference-based learning experiences available to all students. Rather than providing these experiences solely to students formally identified as gifted, SEM schools provide Type I and Type II enrichment to all students in the forms of broad exposure to a wide variety of high-interest activities such as field trips and presentations, as well as small group training experiences called enrichment clusters, in which interest is the primary qualifier for participation. SEM schools also support a talent pool of the top 15%–20% above-average/high-potential students. These students are identified through a variety of measures, including achievement tests. teacher nominations, assessment of potential for creativity and task commitment, as well as alternative pathways (self-nomination, parent nomination, etc.). High achievement test and IQ test scores automatically include students in the talent pool.

The talent pool concept was designed to ensure that students formally designated as gifted receive services, while leaving room for other students who demonstrate gifted responses to particular forms of instruction or learning experiences. By assuming that gifted behaviors, such as task commitment and creative productivity, occur in certain people at certain times and under certain conditions, Renzulli (1977) also assumed that instructional preferences were more statelike than traitlike. Under the right conditions—a high level of interest being one such condition—students may, and often do, respond favorably both to preferred instructional styles and to styles and activities for which they might have a low preference under typical classroom experiences.

All of these experiences revolve around student preferences and motivation. We assume, as educators and researchers, that students working in their preferred styles of learning and in areas of keen interest are likely to do their best work. As noted by Curry (1990), learning styles may affect academic performance by increasing or maintaining motivation in students, which in tum may lead to greater task commitment and perseverance. A meta-analysis (Schiefele, Krapp, & Winteler, 1992) of studies from 18 different countries also provided support for the importance of motivation in achievement. Across studies, which included 121 independent samples, ranging from grade 5 to grade 12, the correlation between interest (an intrinsic motivator) and achievement was .40. Schiefele et al. noted that this finding, along with other findings related to interest, suggested that it may be a more powerful predictor of achievement than many other affective variables.

The LSI-III was designed to be a teacher-friendly tool for tapping into students' interests and motivations, by providing information about students' instructional preferences. The underlying assumption was that teachers, as a matter of course, seek to match instruction to student needs. However, traditional research has reported that teachers have often used informal methods such as observation to make instructional decisions (Cronbach, 1967; Lesser, 1971). This method of decision making leaves much to chance and can result in classrooms that favor very few instructional style preferences. Moreover, as previously noted, even the most vigilant and intuitive teachers may find themselves challenged when attempting to modify concrete instructional behaviors to fit style constructs grounded in cognitive or psychological theories. The LSI-III was designed to highlight students' preferred learning modes by allowing students to explicitly select instructional methods that meet their preferences.

There are two versions of the LSI-III: One for elementary school students (LSI-III/ES) and one for middle school students (LSI-III/MS). There are slight differences in these two versions to accommodate the different activities that take place in elementary school and middle school classrooms. The instructional preferences assessed by the LSI-III are listed in the following sections.

Instructional Method 1: Direct Instruction

Direct instruction refers to activities with direct teacher input. As implied by the name, direct instruction occurs any time the teacher presents a lesson, explains new information, or presents various viewpoints. Other direct instruction activities include teacher-issued instructions and teacher-lead discussions.

Often, direct instruction is viewed as inferior to discovery learning or student-directed learning, but research suggests that this is not always the case. For example, in a study (Klahr & Nigam, 2004) of more than 100 elementary school science students, children who received direct instruction in designing unconfounded experiments outperformed students who were allowed to design experiments after exploring and experimenting with designs on their own. In this case, direct instruction consisted of a teacher explaining why various experiments did or did not determine the impact of a specific variable on the outcome of the experiment. Seventy-seven percent of the students in the direct instruction cohort were then able to design multiple unconfounded experiments, as compared to 23% of the students in the discovery learning cohort. Students who had received direct instruction were also more successful in critiquing experiments described in science fair posters than were those in the discovery learning group. Another study demonstrated that direct instruction in letter-sound correspondence produced greater reading gains in at-risk first-and second-grade students than did implicit instruction through exposure to literature (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998).

There are several issues that teachers might wish to consider when differentiating for students whose preferences include direct instruction. First direct instruction is more than lecture. Relying heavily on lecture with elementary and middle school students is a poor use of direct instruction. Alternating between lecture and questions may help students to stay connected to the lesson. Infusing storytelling might increase interest in the topic at hand. In addition, the teacher may have students summarize information or react to information to promote active engagement. Concept attainment is another consideration for this style. Teachers should provide examples and nonexamples of the concepts being introduced. Asking students to do the same can engage the students in a meaningful manner. Finally, guest speakers may help provide students with alternate viewpoints as well as add expert depth to the material.

Instructional Method 2: Teaching Through Technology

Instruction through technology involves the use of computers and other forms of educational technology to learn new information, review information, and participate in interactive activities. Activities that involve the Internet and communicating via e-mail or in chat rooms are also included, as are more traditional technology methods implementing audio-visual equipment.

Technology lends itself quite naturally to the goals of differentiation, as students often work independently or in small groups with information technology, moving at their own pace. However, this does not mean that all uses of technology are beneficial in the classroom. Wenglinski (1998), for example, found a negative relationship between frequency of school computer use and student achievement. He noted that extremely high use of computers at schools might suggest use of technology for unproductive purposes, such as playing games without educational value. What was important, he noted, was how technology was used. Schools where higher-order skills were taught via technology showed higher achievement than schools that reported using technology primarily for activities such as drill and practice.

These findings were supported by Kozma (2003), who found that certain practices involving technology were likely to produce learning gams, while others were not. In an analysis of 174 case studies of classroom technology use from 28 different countries, studies that involved students who worked collaboratively and used technology for multiple purposes tended to report positive outcomes. Specific technology-related activities that resulted in learning gains when used in combination included searching for information, analyzing data, solving problems, publishing results, creating products, and evaluating others' work. These outcomes included increased knowledge of information technology and improved communication, collaboration, and problem-solving skills. In addition, many teachers involved in these studies reported the acquisition of new pedagogical skills. By comparison, cases in which technology was primarily used for drill and practice, or for e-mail communication, resulted in few teacher or student gains.

Teachers seeking to use technology to differentiate in the classroom might ask students to create a Webquest module or design a Web site using a project model that allows students to work through a concept at their own pace. Providing students with a choice of Web sites for finding information on a specific topic may allow them to make selections based on interest, a variety of style constructs, and ability. Likewise, the once unimaginable volume of information offered on the Internet makes finding resources for interest-based projects faster and easier than ever before. Using the variety of formats available via technology (i.e., video, multimedia, audio, and text) can also help to accommodate various learning modalities.

Instructional Method 3: Simulations

Simulations are activities that involve role playing, acting, and engaging in real-world tasks. As the name implies, simulations require students to assume roles, make decisions, and face the consequences of their actions, all of which are mediated by the students' own experiences and personalities. Simulations provide a vehicle for concept attainment that can be altered according to students' interests and ability levels.

As is the case with other instructional methods, simulation has strengths and weaknesses. For example, a meta-analysis (Dekkers & Donath, 1981) exploring the impact of simulation activities on learning found that simulations were more effective than lecture when attempting to induce attitudinal change in students. However, the meta-analysis suggested that simulations were no more likely than lecture to increase cognitive development or retention of material over time. As noted by Dekkers and Donath, simulation could be a useful supplement to other teaching methods in a differentiated classroom. Teachers seeking to differentiate for students who enjoy simulation might include mock-trials, computer simulations, and other experiential activities that encourage students to take perspectives and engage in "as-if" experiences.

Instructional Method 4: Independent Study

Independent study activities are those in which a student works alone. Activities include studying, preparing projects, information gathering, and reading. Activities can be student or teacher initiated, but independent study requires students to structure their time and maintain attention during work periods.

Independent study is an example of an instructional method that should be applied selectively and judiciously. There is some evidence to suggest that students designated as gifted (as defined by standardized achievement or cognitive ability tests) may prefer working independently; whereas typical students prefer teacher-directed or group work (Ricca, 1984; Stewart, 1981). However, other research (Yen, 1978) has shown that while some students do indeed demonstrate higher achievement when allowed to study independently, there is not necessarily a direct correspondence between intelligence and an affinity for self-directed learning. In fact, Yen found that most students performed better under drill/recitation conditions than under independent study conditions. Ideally, teachers would use an instrument such as the LSI-III (Renzulli et al., 2002) to determine which students might benefit from increased access to independent learning situations.

Instructional Method 5: Projects

Projects fit naturally into differentiated classrooms because they typically allow some level of choice in topic, process, and product style. Successful projects, however, require planning on the part of teachers, as well as knowledge of individual students. As noted by Baron et al. (1998), illdefined and poorly planned projects can become "doing for the sake of doing," rather than legitimate learning experiences (p. 272). To avoid this outcome, Baron et al. recommended that teachers design project experiences with learning objectives in mind and a clear idea of how the activities undertaken by students will foster deep understanding of targeted concepts. They also noted the importance of scaffolding projects to ensure that these experiences do not become simple exercises in carrying out procedures. Examples of useful scaffolding noted by Baron et al. included reflection periods incorporated into activity periods and provision of informational resources that allowed students to solve problems as they arose during the life of the project. Assessing students' learning throughout and formally incorporating self-assessment may also allow teachers and students to identify what is being learned during a project. This in tum may encourage students to seek out resources on their own when restrictive conceptual or informational gaps become apparent, according to Baron et al. Finally, Baron et al. suggested using the power of social motivation to fuel learning through projects. They recommended making individual students in group learning experiences accountable for particular tasks or accomplishments, as well as allowing students to present projects to outside audiences. Each of these elements harnesses social reinforcement in service to learning.

After implementing a structural design project adhering to these guidelines, Baron et al. (1998) found that almost all fifth-grade students who had participated in the project could transfer learning to a new design task (i.e., drawing a blueprint for a chair). Moreover, blueprints were in almost every case objectively judged as superior to blueprints drawn prior to the project. The researchers also found that students increased their knowledge of standards-based geometry incorporated into the project, as measured by a traditional pen and paper test. Finally, they found that project participants almost universally described the project as an important part of their fifth-grade experience. These findings suggest that teachers can implement well-designed projects with students who prefer this style without sacrificing learning.

Instructional Method 6: Peer Teaching

As indicated by the name, peer teaching includes activities in which students work with peers to learn new information or review previously learned material. The main focus of these activities is the relationship between the students, which involves a reciprocal learning model.

Peer teaching has been shown to be an effective instructional technique for a variety of students. A recent meta-analysis (Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003) of peer-assisted learning strategies found that these activities may be particularly useful for lower-elementary students and certain at-risk students, such as urban and minority students. Teachers can differentiate by pairing students who share a fascination with the same topic or by pairing students based on ability levels.

Instructional Method 7: Drill and Recitation

Drill and recitation activities include quizzes, response and answer sessions, and assignments that ask students for specific information. The drill component can take the form of oral or written work. While drill and recitation should not be the only instructional strategy in a teacher's toolbox, it can be an effective method for teaching information considered to be foundational to higher-level learning, such as math facts (Woodward, 2006). In addition, drill and recitation has been shown to be an effective component of reading instruction for students with learning disabilities, who may benefit from practice drills to compensate for deficits in short-term memory (Oakland, Black, Stanford, Nussbaum, & Balise, 1998).

Instructional Method 8: Discussion

Discussion involves activities that allow students to share their ideas and opinions. Ideally, educational discussions incorporate skills such as comparing and contrasting, judging sources, and recognizing the validity of others' opinions.

Discussion, by its very nature, is engaging. In one recent study (Del Favero, Boscolo, Vidotto, & Vicentini, 2007), students who were asked to solve historical problems through group discussions reported greater enjoyment and a deeper understanding of historical inquiry than did students in an independent learning cohort. Enjoyment alone, however, does not make for meaningful learning. Teacher input is required to ensure that discussion promotes understanding of key concepts. King (1994) found that, when compared to unguided student discussion or discussion focused solely on text, guided discussion in which students were trained to connect questions to concepts in text and personal experience promoted the highest level of conceptual discourse. Teachers using discussion with students in a differentiated classroom might group students based on shared or different experiences and interests or on ability level to achieve the greatest degree of student engagement.

Instructional Method 9: Teaching Games

Teaching games are games and contests that allow students to learn and/or show what they have learned. They are purposeful in nature and extend the curriculum in some way. Games are intuitively appealing; thus, it is not surprising that some researchers (e.g., DeVries & Edwards, 1973; Mumtaz, 2001) have urged educators to harness the power of games in teaching and learning. However, although research has suggested that some computer games can affect cognition in children (Aliya, 2002), there has been little research on the relative value of games as compared to other instructional models, or on how games may best be implemented in the classroom. Nonetheless, teaching games hold promise when well considered by educators. Virvou, Katsionis, and Manos (2005), for example, presented an interesting case study of a virtual reality geography game that produced both educational gains in elementary school students and a certain level of "fascination" on the part of students previously unmotivated by the topic (p. 63). Like any form of instruction, educational games may be one component of an effective collection of instructional strategies implemented in a classroom. Teachers may differentiate by allowing students to choose from among a variety of games involving different content and/or processes or by grouping students by ability level for games. Students can also be encouraged to design their own games that help them to learn and practice material.

Conclusion

As noted, the field of styles has a long, rich, and complex history that in some ways reflects the complexity of the various constructs falling under the styles label. We believe that styles can be tapped for educational purposes, and that classrooms where one or two styles are consistently favored fail to maximize students' learning potential. However, the very complexity of the styles literature and constructs may prevent educators from differentiating by style.

Enjoyable, engaged learning occurs when the instruction is varied and keyed to student preferences (Davidson, 1990; Fitzgibbon, Hey-wood, & Cameron, 1991; Saracho, 1990). Understanding the relationship between styles and learning efficiency is a necessary first step toward differentiated learning environments that result in actual classroom change (Stahl & Kuhn, 1995). Instruments such as the LSI-III can help teachers bypass the cognitive, personality, and information-processing preferences that underlie many style constructs, in favor of tapping directly into students' preferences for various types of classroom activities. This in tum may make differentiating for various styles more feasible and enjoyable for teachers.

Focusing on instructional styles may also allow educators to bypass difficult questions and value judgments prompted by other style constructs. For example, there may be comparatively little urgency in discerning whether instructional preferences are statelike or traitlike, as most students will respond to a variety of instructional formats, and, as discussed, students may embrace even less preferred instructional styles in service of a high-interest project or activity.

Moreover, while early educational settings may favor students with preferences for direct instruction, drill and recitation, and other highly structured activities, few assumptions are made about a person's intelligence or worth based on his or her preferences for one type of instruction over another. Different educational environments and activities favor different preferences. A talkative student who is frequently the object of ire in a classroom focused on teacher-directed activities may shine in a seminar environment or excel at peer tutoring. This flexible value system differs from the judgments surrounding some other style constructs—value judgments that may cause us to overlook students' very real abilities and cast an elitist pall over the very idea of styles. By placing emphasis firmly on the aspect of styles most relevant to the classroom—that is, diversity in preference and response to various classroom activities—educators may be able to take what is needed from the idea of styles, without absorbing some of the more complex and troublesome aspects of style constructs. Moreover, by so doing, the focus may shift in education from the relative value of various styles to encouraging students to seek out environments that capitalize on their own styles, strengths, and interests.

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