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Use of learning styles in the selection of instructional strategies : Does pedagogy lead to practice?

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Abstract

Much has been written about the importance of learning styles in instructional design. Learning styles can be measured by the use of personality profiles such as the Myers-Briggs Type Indicator (MBTI). Learning styles can also be measured by Learning Style Inventories and defined by cognitive theory such as Gardner's multiple intelligences. This literature review explores the different approaches to the study of learning styles and the practical use of learning style indicators as a tool for selecting instructional strategies.

Many challenges exist in designing instruction to the personal level including costs, time, and instructor limits. Philosophical questions on the benefits of customization must also be considered. Research supports the need to have variety in instruction to better simulate real-world application. This literature review concludes instruction should be learner centered, but does not need to be personality centered.

USE OF LEARNING STYLES IN THE SELECTION OF INSTRUCTIONAL
STRATEGIES: DOES PEDAGOGY LEAD TO PRACTICE?

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INTRODUCTION

To what extent do instructional designers use learning styles in the selection of instructional strategies? This literature review will explore the challenges of the practical application of learner characteristics in choosing instructional strategies, and will reach a conclusion on the appropriateness of their use in the selection of these strategies.

The review of this literature will show advantages and challenges in giving consideration for the learner's learning style in the design and transfer of learning. The personality profiles that measure learning styles are used widely and extensively (Shindler, 2006). Some are simple and some are complex, but most are generally considered to be of value in identifying traits that can be used to make learners more successful (Felder & Brent, 2005). This review will show why learning styles are often generalized for the design of the instruction and are seldom tailored to the individual in the delivery of learning. Limits exist to the practical use of learning style data (Corno & Snow, 1986). This review discusses some trade offs that must be made and the advantages and disadvantages of the use of learning styles in the selection of instructional strategies.

The analysis of learning styles is important to educators, trainers, and instructional designers because it connects some commonly believed theory to real-life practice (Felder & Brent, 2005). This view might lead some to re-examine personal beliefs and strengthen or change individual practices.

The effectiveness of learning and the appropriate selection of learning strategies are important for many reasons. For business, the impact is economic (Harburg, 2005). For higher education, the impact is the intellectual growth of the individual. Learners in

both fields apply acquired knowledge to contribute to society (Reid, 2005).

This literature review focuses on the use of some of the more popular *personality profiles* and learning indicator tools. It would be impossible to cover all the different ways of measuring learning styles or learner preferences. This review will be confined to widely used measurement tools and not the individual or custom-created surveys that some instructional designers have created for learner analysis.

METHODOLOGY

The University of Northern Iowa Rod Library was used for the selection of resources. UNISTAR, EBSCO and the Internet were used. The descriptors used included: learning styles, personality profiles, instructional strategies, personalized instruction, differentiated learning, Gardner, multiple intelligences, personality/training, learning styles/applied, Gregorc's model, Dunn and Dunn, Kolb's experiential, MBTI, Myers-Briggs Type Indicators, and learning environments/design.

The Rod Library was selected as a source for its extensive collections and reliable search features. The Internet was used as a source for its quantity of work on this topic but only sites with credible resources were used. Sources taken from the Internet were written by professors and published on *.edu* sites, referred publications, or were from professional organizations in the field of education. A third source was the recommendation of faculty in the Department of Education, Instructional Technology Division at the University of Northern Iowa.

The resources were selected for relevance and credibility in the field of instructional design. The recommendations of the faculty yielded several well-matched sources. Scholars who use credible references were sought and the quality of the references was considered. Original, interesting or challenging viewpoints were desired, but only if they were supported. Dates of the research were considered and newer research was often found to be more reflective of today's learning environments.

ANALYSIS AND DISCUSSION

To understand the application of learning styles an individual must first understand learning styles. The following paragraphs will examine definitions of learning style, provide an overview of some of the most popular measures of learning style, discuss the pros and cons of learning style indicators, and review relevant scholarly opinions.

Definitions of Learning Styles

Much has been written about learning styles and many definitions have been used. Some definitions are very broad, describing learning styles as a part of a learning cycle and encompassing many theories tools. It is the sum of this collection of theories and tools, as at body of work, that educators refer to as learning style. "Learning style is a gestalt that tells how a student learns and prefers to learn" (Keefe & Jenkins, 2000, p. 52). Other definitions are very narrow. Definitions of learning styles may be limited to just one theory or based on an instrument used to measure the learner's style.

Many learning style theories have evolved from the work of Carl Jung in the 1920s. Jung was a psychiatrist and his work on personality development inspired followers of his philosophy to create a wide variety of personality indicators that have been applied to identifying learning styles. These indicators are discussed in the Measures of Learning Style section of this paper. Others see learning styles as related to various learning theories of educators. Howard Gardner's Theory of Multiple Intelligences identifies eight primary intelligences of a learner and he concludes that individuals can be described as having a single, quantifiable intelligence (Campbell, Campbell, & Dickinson, 2004).

Learning styles overlap and this adds some ambiguity to the definition of learning styles. Learning styles have a connection to: learning theory, learning strategies, thinking styles, multiple intelligence, cognitive style, metacognition, and teaching style. These elements often identify a condition and are sometimes referred to as *type* or *style*. However, they can also be summarized as *preferences* to avoid the stigma of a *label* such as a style or type (Reid, 2005).

The field of Learning Styles can at times seem to be fragmented and disconnected. Some scholars have tried to make sense of these confusing perspectives and wide-ranging tools. Frank Coffield and his associates (Coffield, Mosely, Hall, & Ecclestone, 2004) grouped 71 learning style models into classification systems. “They (Coffield et al.) developed a continuum of models based on the extent to which the developers of these models believed that learning styles represented a fixed trait” (Reid, 2005, p. 52). Reid (2005) suggests that Learning Styles can be grouped by those that focus in the following ways: (a) personality styles, (b) environmental influences, (c) cognitive styles, and (d) metacognitive influences.

Learning styles is such a broad and varied field because of all the environmental influences and factors. Reid (2005) identified outside factors as *Influencers* and *Mediating Factors*. Influencers included: (a) personality, (b) environment, (c) thinking style, and (d) self-awareness. Mediating Factors included: (a) culture, (b) school climate, (c) expectations, (d) teaching style, and (e) classroom practices. These outside factors and environmental influences are often included in definitions of learning styles and they demonstrate the depth of the field of study.

For this review, both personality indicators and learning theory’s contributions to

learning style are explored. The definition chosen for this review is based on the work of James Keefe as interpreted by David Merrill. "Learning Styles are the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment" (Merrill, 2002, p. 100). Or, more simply stated, learning styles are a preference of the learner recognized by the instructor (Corno & Snow, 1986).

Measures of Learning Styles

The Myers-Briggs Type Indicator

Learning styles are often measured by one of over 2,500 personality tests. "Virtually all current style-based systems reflect one or more of these three lines of research: on information styles, personality-related tendencies, and the relationship of individual differences to instructional method" (Keefe & Jenkins, 2000, p. 40). These tests are a 400 million dollar industry that is growing by 10% a year (Harburg, 2005).

Swiss psychologist Carl Jung's Theory of Psychological Type is the best known of the psychological type theories. Jung's theory was made popular by the Myers-Briggs Type Indicator (MBTI) (Felder & Brent, 2005). MBTI was the work of two American women, Katherine Briggs and her daughter, Isabel Briggs Myers. More than 2.5 million people took the popular Myers-Briggs Type Indicator (MBTI) in the reported year and 89% of the Fortune 100 Companies used MBTI in the same year (Harburg, 2005).

The Myers-Briggs Type Indicator is designed to show the mental processes humans use to learn. MBTI consists of 16 psychological types. These sixteen types remain the standard for the field (Thompson, 1998). The personality types common in Jung are a composite of eight characteristics; of which, an individual may fit only four

dimensions. They are called dimensions because they are a point on a continuum (Tieger & Barron-Tieger, 1995). An individual is either (E) extroverted or (I) introverted, (S) sensation or (I) intuition, (T) thinking or (F) feeling, and (P) perceiving or (J) judging. Therefore, the sixteen possible combinations of personality type are: ESTP, ENTP, ISTP, INTP, ESTJ, ENTJ, ISTJ, INTJ, ESFP, ENFP, ISFP, INFP, ESFJ, ENFJ, ISFJ, and INFJ.

The first letter indicates an individual's preference for getting and using energy. The second letter explains how that individual gathers and takes in information. The third letter represents the individual's decision process and the fourth letter is how the individual organizes life. Personality types or styles are not *right* or *wrong*. "No preference is more valuable or better than any other" (Kummerow, Barger, & Kirby, 1997, p. 9). Learners are cautioned to not attempt to score in an area they feel is more valuable.

Entire books have been written on the traits and meanings of these sixteen sets of initials. MBTI research has been supplemented with modern research in the field of neurology in a way that has extended its usefulness and potential (Thompson, 1998). MBTI is not just a Learning Style Indicator. MBTI is extensively used in business in team building and in the discovery of management and leadership styles. An individual can also use MBTI in their personal lives in self discovery or even in career selection.

Quenk (2000) summarizes the strength of the Myers-Briggs Type Indicator as follows: (a) it provides context for understanding individual complexity, (b) its nonnormative basis of preferences identifies individual differences as normal, and (c) the test is parsimonious. It requires only four measured constructs to yield rich personally descriptions with broad applicability.

Myers-Briggs Type Indicators are not without weaknesses. Simplicity of the questions encourages the idea that the typology is simple and static when it is complex and dynamic (Quenk, 2000). Fitzgerald and Kirby (1997) point out three cautions in interpreting the meaning of these indicators: (a) common characteristics are derived from groups, the individual will display *most* of the characteristics, but some individuals might display a wide variety of behaviors and skills within that characteristic, (b) type preferences do not directly indicate a skill or preference and some who possess that skill may not use that skill well, and (c) the development process might influence how preferences are expressed. For example, different stages of life and growth may demonstrate different use of the same preference (Fitzgerald & Kirby, 1997). MBTI is not an assessment of ability and should not be used as such. Preferences and abilities are two different things, all individuals have abilities, but some may prefer a learning modality (Kummerow et al., 1997).

Other Learning Style Indicators

Other popular learning-style indicators are: Dunn and Dunn, Kolb, Gregorc, Multiple Intelligence, and Learning Modalities (Shindler, 2006). This section discusses five of the more popular or widely-used indicators. They are:

1. The Dunn and Dunn Learning Style Model is based on a Learning Style Inventory (LSI) that contains 104 items in five domains: (a) environmental, (b) emotional, (c) sociological, (d) physiological, and (e) psychological. These five domains are subdivided into 21 elements. The Learning Style Inventory is complex and can assess elements in combinations; however, it can be completed in just thirty to forty minutes by elementary to secondary students (Reid, 2005). The LSI is optically read and a copy is

provided to each student with a graphical representation of the condition in which they learn best.

2. David Kolb is an advocate for Experiential Learning and his Learning Style inventory's primary focus is on adult learners (Reid, 2005). Kolb's Learning Style Inventory (LSI) is based on just twelve items that focus on four types of learners: (a) divergers, (b) assimilators, (c) convergers, and (d) accomodators. For each statement, responders choose which answer is the first, second, third and fourth most likely action or feeling (Richlin, 2006). Kolb's LSI is a derivative of Jung's psychological types but also is influenced by Piaget's emphasis on assimilation and accommodation (Reid, 2005).

3. Gregorc's Style Delineator places learners on a continuum of *Perception* from concrete to abstract and on a continuum of *Ordering* from sequential to random and plots those four styles on two axes. When plotted, the graphs show how strength in one area will result in a balance among all four styles (Reid, 2005). The theory was developed as Anthony Gregorc studied why adults and children were not learning what they *should* be learning. It addressed "the question of how, why and what individuals can, will and do learn" (Gregorc, 1982, p. 1). Gregorc found that the human mind has *channels* that it uses to receive and express information effectively. The degree to which it uses these channels he terms mediation abilities. The outward appearance of these mediation abilities that educators refer to as *styles* (Gregorc).

4. Howard Gardner' Multiple Intelligence Theory (MI) is based on eight intelligences: (a) verbal/linguistic, (b) musical/rhythmic, (c) naturalistic, (d) interpersonal, (e) intrapersonal, (f) visual/spatial, (g) logical/mathematic and (h)

bodily/kinesthetic. A ninth intelligence – existential intelligence has been added (Richlin, 2006). Others have been proposed and Gardner admits there may be others.

Gardner's theory is partly a result of his discontent with how student achievement was largely based on success with the use of symbol systems such as language and math (McCown, Driscoll, & Geiger Roop, 1996). Gardner realized there were additional ways to measure intelligence. The origin of MI is both physiological and psychological. Gardner's research began with the study of brain-damaged patients. Gardner rejected viewing intelligence based on the score of a standard test. He defined intelligence as "the ability to solve problems that one encounters in real life, the ability to generate new problems to solve, and the ability to make something or offer a service that is valued within one's culture" (Campbell et al., 2004, p. xx). Gardner cites Piaget and Chomsky as he "seeks to bridge biology and culture, brain research and language development, as they shape the cognition of the infant" (Buchen, 2006, p. 118). His work challenged the singular measure of IQ in favor of the norm of multiple intelligences (Buchen, 2006).

5. The study of Learning Modalities has lead to multiple learning style theories.

The three basic modalities to process information to memory are: (a) visual (learning by seeing), (b) auditory (learning by hearing), and (c) kinesthetic (learning by doing). Most people have one predominant modality, but some have a balance between two or even all three. About 98% of what individuals learn enters the brain through the senses and they build preferences for how they learn through these senses. Networks of neurons are used to solve problems in the easiest and fastest way. An individual will continue to use those networks until the connections become stronger and a preference for that sense is built (Tileston, 2005).

Barbe and Swassing are known for research in the importance of learning modalities in teaching and learning. "According to Barbe and Swassing; sensation, perception and memory together create a modality" (Sprengr, 2003, p. 33). An individual has a visual, auditory and kinesthetic memory system. It makes sense that the more the senses are activated the more likely information will be coded (Sprengr, 2003). However, balance is important in the processing of sensory information. Grinder found in a research study that, out of thirty students, twenty two will be balanced in the ability to use their sensory pathways but, of the remaining eight, five or six students will have difficulty learning through a non-dominant sensory path (Sprengr, 2003). Students' modalities can be measured in multiple ways. One of the most reliable methods of identifying sensory preferences is observation (Sprengr, 2003). However, a variety of inventory tools are available in survey format. These surveys go by a variety of names such as VARK, PALS and TOLS and many can be found on the Internet.

A final inventory tool to be covered is the Grasha-Riechman Student Learning Styles Scales Inventory. Grasha and Hruska-Riechmann developed a tool to identify six styles of learners. These categories are: (a) Avoidant, (b) Dependent, (c) Participant, (d) Independent, (e) Competitive, and (f) Collaborative. In over three decades of research and thousands of students, Grasha has found no significant difference in the learning styles among different academic majors or between graduate and undergraduate learners (Richlin, 2006). There were some differences in the learning style by gender and age. Also, students with an Avoidance Style tended to receive lower grades and students with a Participatory Style tended to receive higher grades. Students in online courses had higher independence scores and on-campus learners had higher dependent scores

(Richlin, 2006). Gasha notes that learners do not have just one style and that all learners are a blend of styles. Grasha also developed a companion Teaching Styles Inventory to “describe the stylistic qualities of teachers and students, to show how they related to each other, and to offer suggestions for how this information could be used to enhance the nature and quality of classroom experiences” (Richlin, 2006, p. 35). The benefits of the relationship of teaching styles and learning styles will be seen in our next section on the importance of learning styles.

Importance of Learning Styles

Learning styles are a valuable tool for education and training as they move from instructor-centered instruction to learner-centered instruction. Historically, teachers based instruction on personal preferences or experiences. McKeachie (1995) found that “too many teachers think of students as a featureless mass; too many rarely vary their teaching methods, thinking that the method by which they were taught is best for everyone” (p. 1). Varying instruction based on learning style will facilitate an easier transfer of knowledge for the learner and makes instruction learner-centered.

If learning styles are recognized by the instructor, Corno and Snow (1986) argue, those preferences should be included in the selection of instructional design. “In brief, the argument is that whenever an instructional prescription is different for one student than for another, the implication is that both will be helped by following their own prescriptions rather than someone else’s” (p. 610). This personalization of instruction is different than offering remedial help to a challenged student. “A school might offer a wide array of enrichment and support services and still never ask its students who they are, what they are good at, and where they want to go in life” (Dimartino, Clark, & Wolk,

2003, p. 64). Personalized learning makes learning relevant and style-based instruction can be used as a tool for personalized learning.

The use of learning styles can also lead to teacher success. Corno and Snow (1986) stated, "Research indicates teachers improve at their craft in part by examining whether or not they reach individual students" (p. 613). This reflective element in evaluating teaching styles leads to teacher success.

Learning styles can also help the individual student develop a better understanding of how they learn best and this knowledge will aid them in the pursuit of life-long learning. It aids metacognitive awareness (how they think about thinking). Learners with a high degree of metacognitive awareness are usually efficient and effective learners (Reid, 2005). Self awareness is a trait that is important to the learner and it should be developed by the teacher.

It follows that knowledge of learning style will help the student become more aware of their individual preferences and their particular learning and study habits. This self-awareness can lead to a degree of metacognitive awareness when it is fully developed by the teacher. Metacognitive awareness will not follow automatically, but students need to be trained in their use of metacognition and self-knowledge will be a useful prerequisite for this. (Reid, 2005, p. 63)

The *experience of learning* may be more important to many learners than the actual learning and therefore, it is important that all learners become aware of personal learning styles (Reid, 2005).

Examining learners by type reveals biases in how educators currently measure intelligence, creativity, and academic achievement. Knowing this bias is the first step to eliminating these biases.

Eighty two percent of the National Merit Scholarships go to students with one particular personality preference (intuition), even though they make up only 30 to 35 percent of the population. A 140 point 'intuitive gap' exists on the PSAT, with a 250 point gap between the top three personality types in score and the bottom three types. The test favors their innate style of guessing. (Kise, 2007, p. 6)

Type is an essential tool for evaluating the current educational system and how achievement is measured. Type moves the discussion away from what is right and wrong as all types are considered normal with valid preferences.

A final benefit of learning styles can be higher retention rates for learners in corporate settings and lower drop out rates for schools. For the institution, learning styles can be significant in "securing retention while offering a unique positioning and marketing message setting the institution apart from the others" (Buchen, 2006, p. 160). The correct use of learning styles can result in higher satisfaction in the learning process and increased results.

In summary, "style-based instruction features many useful elements. Its strengths are its diagnostic component, the potential for flexible learning arrangements, and the use of performance-based assessment" (Keefe & Jenkins, 2000, p. 40). In the next section, the controversies that compliment the strengths of style-based instruction are explored.

Controversies in Learning Styles

Felder and Brent (2005) state that “instruction designed to address a broad spectrum of learning styles has consistently proved to be more effective than traditional instruction, which focuses on a narrow range of styles” (p. 59). But not everyone agrees that learning styles *indicators* are a key to instructional success. Felder and Brent (2005) observed this in the academic community, “. . . notably but not exclusively the psychologists who feel learning style models have no sound theoretical basis and that the instruments used to assess learning styles have not been appropriately validated” (p. 58). But it is not just psychologists who are challenging the validity and use of learning styles. Frank Coffield, a Professor of Education at the Institute of Education in London, has been an outspoken critic of the use of learning styles in education. Coffield, who carried out research with David Moseley and Kathryn Ecclestone, has called for his country’s Department for Education and Skills to stop using the *Learning Styles Booklet* stating it has serious flaws (Institute Of Education, 2005).

Critics challenge a lack of reliability in the learning style instruments used to measure or define a preference. Most of the instruments that assess learning style are self-reported and are essentially questionnaires; they need to be supplemented with other methods of assessment such as observation (Reid, 2005). The data claimed by popular learning style indicators can be questioned. They show *unimpressive* test-retest reliability scores and a high degree of *situational sensitivity* (Harburg, 2005). Prior knowledge, intelligence, and motivation make more of a difference to a learner than the appropriate use of learning styles (McKeachie, 1995). While a lack of scientific evidence in support of the validity of the use of learning styles exists, several studies challenge that validity.

In a study of 9,793 trainees to determine whether newly-learned skills predict success on the job, only four of seven personality trait factors showed a positive correlation with skill acquisition (Oakes, Ferris, Martocchio, Buckley & Broach, 2001).

Coffield, Moseley, Hall, and Ecclestone evaluated 13 major models of learning styles including Dunn and Dunn, Gregorc, Kolb, and Myers-Briggs. They evaluated the models on four criteria: (a) internal consistencies, (b) test-retest reliability, (c) construct validity, and (d) predictive validity. Of the thirteen models only one, the Allinson and Haynes model, met all four criteria: Dunn and Dunn, Gregorc, and Kolb met one criteria; and Myers-Briggs met two (Coffield, Mosely, Hall, & Ecclestone, 2004). They concluded that too much faith is being placed in these simple, self-reported tests.

In addition to those questioning the value or validity of the learning style tests, others feel it is a practice that stereotypes learners. Just as categorizing learners by ethnic group ignores differences that exist within that group, categorizing learners based on a score from a style indicator also ignores differences that exist in a group (McCown, Driscoll, & Geiger Roop, 1996). Some educators have a concern that the use of learning styles can lead to labeling learners and that it can be limiting. Reid (2005) agrees this should be considered by the instructor, but states that learning styles should extend learning and not limit it. Learning styles allow teachers to use their knowledge of student strengths as entry points for instruction and to capture attention (Gregory & Chapman, 2007). "When type is well used, it can decrease labels or substitute the positive language of the preferences" (Kise, 2007, p. 164). In addition to questioning student value, some even question the effectiveness of matching learning styles to teaching styles and teaching materials (Reid, 2005).

The study and measurement of learning styles is a broad field with a high degree of competing perspectives existing even among its supporters. Gardner himself admitted his Multiple Intelligence Theory is like a Rorschach test. Individual teachers and even entire school systems might go about implementing his theory in diverse or even conflicting ways. Gardner asserts that one application is not right and one wrong. He asserts that typically both approaches can be justified for that unique setting (Campbell, Campbell, & Dickinson, 2004).

The commercial element is a controversial one that must be considered in the implementation of learning style analysis. The Myers-Briggs assessment is to be only administered and interpreted by a trained professional. Workshops and expensive materials are often required to be purchased for the programs of higher quality. The measurement of personality styles has become a large for-profit industry (Harburg, 2005).

Dick , Carey and Carey (2005) carefully sidestep any commitment to learning styles stating, "Research indicates that personal styles can be identified, but such styles are often derived from learners' expression of personal preferences for listening" (p. 102). They do instruct designers to find out about learners general learning preferences; however, they chose to "treat learning styles as an aspect of learning preferences until a body of research emerges that confirms practical gains in learning efficiency, effectiveness, and attitudes through individualized instruction based on identification of learning styles" (p. 102). The authors have adopted a wait-and-see approach before endorsing the use of learning styles in the instructional design process.

Instructional Designers and Learning Styles

While compelling arguments can be made for the use of learning styles, arguments can be made for and against the use of personality indicators in the design of instruction. Personality indicators can be used to support adaptive learning. Adaptive learning focuses on environments that are responsive to learners as individuals. Corno and Snow (1986) argue that some adaptation for an individual learner is needed, "When learners are simply recycled through the same teaching operations without such variations [adaptive learning] until a goal is met or not, ... learners must adapt to the given teaching system or drop out" (p. 607). However, Corno and Snow are not seeing instructors use adaptive learning in the classroom. "Some approximations are in existence today and some experimental programs have been developed over the years that incorporate parts of the ideal, but adaptive teaching educational reform has not yet occurred" (p. 609). Corno and Snow cite cost of alternative treatment as one factor. Other factors include: (a) systematic procedures have never been clearly established and validated, (b) the theories have been vague, (c) professional experience has gone largely undocumented, and (d) it is not clear that teachers use a conscious logic in guiding personal attempts at adaptive behavior. The combination of these factors has made it difficult for instructors to use adaptive learning in their classrooms.

Learner style has been less important to instructional designers than other options such as offering differing pace or levels of cognitive challenge.

Instructional designers have instead usually sought to build programs that would be adaptive mainly to the most direct manifestation of cognitive aptitude differences, namely learning rate differences; individualized pace, with repetition

and special coaching for slow students has been recommended in several programs. (Corno & Snow, 1986, p. 609)

The challenge for the instructional designer in style-based instruction is to adjust the learning environment to differences within and among students (Keefe & Jenkins, 2000). Instructional strategies used to vary the learning environment are examined in the next section.

Learning Styles and the Selection of Instructional Strategies

Learning styles are a factor, but not necessarily the primary factor, to consider for the selection of instructional strategies (Merrill, 2002). Merrill considers them a secondary factor.

Appropriate, consistent instructional strategies are determined first on the basis of the goals of the instruction; secondarily, learner style determines the value of the parameters that adjust or fine-tune these fundamental learning strategies. Strategy-by-instructional-goal interactions take precedence over strategy-by-learning-style interactions, regardless of the instructional style or philosophy of the instructional situation. (Merrill, 2002, p. 105)

Felder and Brent (2005) shared that the goal of instruction should be to “equip students with all the skills associated with every learning style category, regardless of the student’s personal preferences, since they will need all of those skills to function effectively as professionals” (p. 58). They suggested a balanced approach that is more global, addressing all students’ needs, and not requiring a measurement of learning style preferences, since every class may contain students with each preference.

Another factor in the selection of instructional strategies is the limit on a teacher's capacity to handle multiple student aptitudes. Corno and Snow (1986) estimate the capacity may be as low as two student aptitude variables: intelligence and academic motivation. They also note the limit for computerized instruction is still unknown.

Given the number and complexity of individual learning styles, it is not easy for instructional designers to effectively and efficiently select instructional strategies. "The 'styles' or 'types' identified by learning style inventories are not little boxes, neatly separated from one another; rather, they represent dimensions along which learners may differ" (McKeachie, 1995, p. 2). The best instruction, instruction that takes motivation and learner differences into account, typically includes a choice (by learner or teacher) among a variety of materials and teaching strategies to suit different students. Teachers can manipulate the organizational structures and vary the materials. They can change the groups, the learning centers, and the reward structures. They can vary the materials by examples, analogies, points of emphasis, and review and summary (Corno & Snow, 1986).

Felder and Brent (2005) described the optimal teaching style as a balanced one that sometimes matches student's preferences to reduce discomfort but it should also go against student preferences at times forcing them to stretch and grow just as they will be when using the skills in life. They encourage variety in assignments, with problems emphasizing practical considerations (sensing strengths), theory (intuitive strengths), individual efforts (reflective), and teamwork (active).

Reid (2005) agrees with the use of balance as a motivational strategy. In addition, he suggests planning, collaboration, differentiation, and learner awareness are critical

motivational factors. He suggests teachers engage in learning styles at the planning stage and suggest that collaboration is necessary with others in a *whole-school* concept.

Learning styles will be addressed if the curriculum is differentiated to take into account the task, the input, the output, and the resources. Learner awareness is important for the learners to realize the advantages and disadvantages of each style of learning (Reid, 2005).

Differences in perceptual strengths and preferences are usually accommodated by introducing new or difficult information in accordance with the individual students' strongest response mode and reinforcing with secondary and tertiary strengths (Keefe & Jenkins, 2000). Keefe (1991) lists eight steps instructional designers can follow in planning learning style-based instruction: (a) diagnose individual learning styles, (b) profile class preferences, (c) determine strengths or weaknesses, (d) examine the subject content for problem areas, (e) analyze students' prior achievement scores, (f) augment any deficiencies, (g) assess current teaching methods for flexibility, and (h) modify the learning environment and develop personalized learning experiences. When planning personalized learning experiences, it should be noted that learners do not automatically benefit from being grouped exclusively with students with the same learning style. Same-style groupings may be helpful for certain tasks and for short periods, but learners can benefit from being teamed with members with different learning styles (Kise, 2007).

Instructional Strategies for the Multiple Styles of Adult Learners

In this section, literature was reviewed that suggested instructional strategies for addressing multiple learning styles. Emphasis was placed on strategies that would meet the characteristics for the Principles of Adult Learning. Knowles (1973) suggests four primary characteristics for adult learning: (a) adults prefer self-direction, (b) adults experiences should be drawn to compliment learning, (c) adults interests and needs should be starting points and guideposts to learning, and (d) adults seek relevance and immediate application of knowledge. The following paragraphs reflect strategies that match these characteristics.

Differentiation is tailoring instruction to meet individual learners' needs, styles, and interests (Kise, 2007). Gregory (2005) shares nine strategies for differentiating instruction. Identified as part of those nine, instructional designers should: (a) rationalize the learning and connect to the learners world, (b) present it as knowledge that is needed, (c) provide access from a variety of accurate sources, (d) allow time for application and rehearsal, (e) offer chances for creativity and dynamic interaction with material, (f) design for a flexible classroom, provide variety, and (g) connect with other teachers/designers. Gregory's strategies are consistent with strategies used in adult learning principles. Gregory also suggests a specific strategy called Cubing that is being used in the K-12 instructional environment. Cubing helps learners look at topics from different angles or a variety of perspectives and allows designers a multidimensional approach to a topic. This strategy could also be applied in corporate instructional design for adults.

Tomlinson (1999) shares six instructional strategies and activities that meet individualized needs. They are: (a) compacting, (b) problem-based learning, (c) group investigation, (d) independent study, (e) choice boards, and (f) portfolios. Most of these strategies are used in adult learning today; however, two of these strategies, compacting and choice boards, might be new terms to many corporate trainers. Compacting encourages an instructor to assess students before beginning a unit of study and allows the student to skip what they already know. The result is the instructor prepares an alternate meaningful plan. Corporate trainers have traditionally done pre-assessments to allow learners to *opt out* of learning, but they might not take the additional step of providing alternative learning opportunities. Choice boards allow a student to select an activity; however, the teacher may present tasks in levels and direct the student to pick from an appropriate level of challenge. Adult learning principles do recognize learning style preferences and could easily adapt choice boards as an instructional strategy. “Choice is perhaps the strongest motivation tool a teacher can employ” (Kise, 2007, p. 64). Among Kise’s suggestions are scaffolded discussions (with thinking time to promote ideas), pocket problems (many problems selected by small groups), and scaffolded role assignments (clear responsibilities).

Keefe and Jenkins (2000) suggest Contract Activity Packages (CAPs) as a possible instructional strategy. CAPs offer students choices of assignments to meet common objectives. CAPs contain a variety of resources for the auditory (audiotape), visual (books, transparencies, videotapes), and kinesthetic (simulations, interactive games) learner and these strategies are also compatible with adult learning theory.

Differentiated instruction will benefit from the *explosion of technology* in the classroom (Moore, 2005). Particularly in the area of meeting learners diverse needs. Technology can be used to enhance instruction, provide access to information, match pace of learning, give learner controls, provide feedback, measuring performance, and increase motivation. “Whatever the format, technology has a motivating quality for students. They often work longer and harder than they would with comparable paper-and-pencil tasks” (Moore, 2005, p. 64). Technology can be used as a tool to allow learners to apply knowledge in realistic ways and technology can be a communication tool for the knowledge learned (Moore, 2005).

Planning for three modalities (visual, auditory, and kinesthetic) is a challenge that most teachers and instructional designers are adept in working with; however, addressing more styles such as eight multiple intelligences can be a challenge. Complex activities such as teaming, projects, and apprenticeships are effective ways to address multiple intelligences. In addition, tools such as planning matrices and instructional menus can also be used to provide additional instructional options (Campbell et al., 2004). Gregory and Chapman (2007) share a menu that can be used to meet the challenges of instructional design for multiple intelligences and also provide a *palette* of strategies to aid in instructional design. They offer between ten and twenty-three instructional strategies for each of the eight multiple intelligences.

CONCLUSIONS AND RECOMENDATIONS

In simplest terms, one definition of learning styles is a preference of the learner recognized by the instructor (Corno & Snow, 1986). Educators prefer to call personality type indicators a preference and are careful not to associate learning styles with *labels*. The point of identifying learning styles is not to label individual students. Kise (2007) points out that the positive acceptance of these preferences might actually decrease the labeling bias.

The literature reviewed indicates that there are at least 70 learning style models. Many of them trace their history to Carl Jung's theory of psychological type. Others are at least partly physiologically-based. Most theories consist of some type of measurement of a learning style indicator. These measurements have become a tool for personalization of instruction. Learning style theory has been recognized as an aid for moving to more student-centered instruction. Proponents of learning styles believe their use can assist in student retention by making learning relevant. These proponents feel learning style indicators can not only help the student, but they can aid the instructor in matching their teaching style to the learner.

There are conflicting views on the value of learning styles and some professionals even question their validity. Gardner concedes there are sometimes conflicting ways his Multiple Intelligence Theory is implemented but defends those conflicts as being correct for each unique learning environment (Campbell et al., 2004). Coffield et al., (2004) and Oakes et al. (2001) have found in their research that the measurement of personality type indicators to not be reliable indicators for identifying learning styles and applying them. Others also question the reliability of the measurement and its applicability in learning

(Felder and Brent, 2005, Harburg, 2005, Reid, 2005, and McKeachie, 1995). Although some, such as Reid (2005), see a value in the learner knowing their personal learning style and encourage learners to use it in their pursuit of life-long learning.

While the concept is controversial, the balance in the literature tends to lean toward supporting the assumption that instructors do not need to know students' learning style indicator type. Nor do educators and designers want to make 25 instructional plans for a class of 25 students. In fact, as Felder and Brent (2005) point out, a perfectly tailored individual learner plan would not prepare a learner well for the challenges of working in real-world situations. The goal is to provide a wide range of learning styles in instruction, not only to comfort, but to challenge learners (Felder & Brent, 2005).

This literature review sought an answer to the question, "to what extent do instructional designers use learning styles in the selection of instructional strategies?" The literature recommends that instructional designers acknowledge the value of knowing an individual learner's learning style, but they often fail to measure those styles with a learning style indicator. These educators are not being hypocritical. Many instructional designers depend on the instructor's skill in making instructional adaptations to individual learners based on the instructor's personal observations. Sprenger (2003) suggests personal observation is one of the most reliable ways to gather information for providing individualized instruction. Felder and Brent (2005) encourage instructional designers to prepare challenging classes using a variety of learning strategies to address multiple styles and instructors can fine tune these instructional activities to meet learner needs.

Traditional training classrooms will find it impossible to accommodate *all* the

learning needs of *all* individuals, and it would not be prudent to do so. Instructors have a limit as to how many accommodations can be made, as shown in Corno and Snow's (1986) research. For instructional designers who wish to address learning styles, there are a variety of instructional strategies to choose from that align with adult learning principles.

This literature reviewer would challenge future researchers to explore computerized instruction. It may hold the key to more micro-level adaptations. Computers and computer-driven programs might make learning styles more well-known and easier to apply to instructional design in the future. Corno and Snow (1986) support the idea that artificial intelligence might make the selection of instructional design more scientific and personalized instruction more practical.

The reviewer's original assumptions included the thought that a high percentage of instruction was created with only general knowledge of the learner and that the individual's learning style was not being considered in the instructional design process. The research supported the use of generic information in the selection of learning styles, but encouraged a variety of instructional strategies that comfort but also challenge the learner (Felder & Brent, 2005). The literature reviewed indicated that instructional designers should use learner assessments in the selection of instructional design and they should vary instruction to meet the needs of a variety of styles, but they do not need to conduct personality profiles for each individual learner, nor do they need to create an individualized instruction plan for each learner. Instruction can be learner-centered without being personality-centered.

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