LEARNING STYLES AND GENERATIONAL DIFFERENCES: DO THEY MATTER?

Evaluating the Impact and Variability of Learning/Cognitive Styles and Generational Differences on Instructional Design

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The recurring debate concerning the efficacy of learning styles and their impact on learning outcomes has been reflected in the literature for the past 60 years. However, the research has not overwhelming supported the premise that learning styles are useful in determining the most appropriate instructional media or teaching strategy to deliver content. To that end, the categorical labeling of generational differences, i.e., digital natives vis-à-vis digital immigrants, and their perceived effect on how they learn may not be an appropriate variability to consider when designing instruction. Since the goal of designing instruction is to attain desired learning outcomes and ultimately improve human performance, the question an instructional designer must address is: Should learning styles and generational differences be considered as variables when designing instruction? Consequently, this paper will explore the applicability of learning styles and generational differences applicable to the instructional design process.

The Essence of the Debate

Learning styles theorists generally look at *how* students learn, not *what* they learned. This is based upon information acquisition theory of multimedia learning which holds that learning consists of receiving information and makes unwarranted assumptions about how people learn. However, it assumes people learn by adding information to memory, *"as if the mind were an empty vessel that needs to be filled with information"* (Clark & Mayer, 2011). By emphasizing the *how* of instruction, learning styles practitioners lose sight of the *what* of instruction and tend to "profile" learners based upon perception.

Currently, there is no holistic [overall] theory of learning preferences. The point being that what is commonly referred to as learning styles, others have labeled as cognitive styles, learning preferences, learning capabilities, cognitive control, multiple intelligences, etc.

The genesis of the debate on the [VAK] theory of learning styles is that if you can design instruction that matches a student's "style", they should learn better, per se,

- The visual learner will understand best when information (content) is presented to the visually.

- The auditory learner will understand best when information is described to them orally.

- The kinesthetic learner will understand best when they can touch/fell the what is being presented to them (Willingham, 2005)

However, these are statements of predictability, per se, you are predicting learning outcomes based upon learning "styles". The assumption is once you identify a specific style, you can design instruction that best fits the style. While learning styles' theory appeals to the underlying culture's model of the person ensures the theory's continued survival, despite the evidence against its utility. "Rather than being a harmless fad, learning styles theory perpetuates the very stereotyping and harmful teaching practices it is said to combat" (Scott, 2010).

A recent article in the Chronicle of Higher Education entitled *Matching Teaching Style to Learning Style May Not Help Students* (2009) addressed the aforementioned question. The article summarized a comprehensive meta-analysis on learning styles that revealed that there is not a compelling argument to support the predictive validity of measures of learning styles on learning outcomes (Pashler, McDaniel, Rohrer, & Bjork, 2008). A decade earlier, a similar conclusion was reached when Stahl (1999) found that research failed to demonstrate that assessing children's learning styles and matching those to instructional methods had any effect on their learning. Additionally, in a recent article appearing in the *Australian Journal of Education* stated "research conducted over the last 40 years has failed to show that individual attributes can be used to guide effective teaching practice" (Scott, 2010). Furthermore, the foremost text on multimedia design for e-learning cautions "there is little evidence to support most learning styles *(*Clark & Mayer, 2011).

Nevertheless, there is a strong intuitive appeal to the notion that individual preferences and styles of learning must play a significant part in learning outcomes. Indeed, those who teach and those who learn notice the variability in the speed and manner with which their students acquire new information and ideas, and it seems reasonable that planning instruction to adapt to individual learning should yield improved learner outcomes (Coffield, Moseley, Hall, & Ecclestone, 2004).

The Learning Style Hypothesis—True or False?

The hypothesis of the learning styles theory is as follows: *Learning is optimal if the learning method is matched to the student's learning style.* As with any scientific hypothesis, two key questions should be asked:

1. How would we know the hypothesis is true, or what type of evidence would show that the hypothesis is true?

2. How would we know the hypothesis *is not true, or* what type of evidence would show that the hypothesis is not true?

The theory of learning styles is attractive, and it sounds like common sense. It is also convenient, offering a rationale of escaping accountability and getting rid of responsibility (Learning Styles Fray: Brilliant or Batty, 2010). "Based upon the most thorough review of experimental studies known to date, which sought to objectively find answers either in support of or against the hypothesis described prior, did not find evidence in favor of the learning styles hypothesis, per se, that learning is more effective when teaching matches the learner's style" (Pashler, et al., 2008).

Reliability and Validity

Whereas the discussion on learning styles focuses on individual differences in learning, it *should* focus on the whether learning styles can be used to *predict* performance. Despite the commonly held belief that learning styles—most notably the visual, aural, and kinesthetic (VAK) models (Sharp, Byrne,

& Bowker, 2008)—affect performance, there is a debate about whether learning styles even exist, and that perhaps the only current evidence of their existence are the tests used to identify them. Any discussion concerning the research on learning styles, therefore, must address the reliability and validity of the instruments used to identify learning styles.

Simply stated, *validity* refers to whether a test appears to be measuring what it purports to measure, and *reliability* questions whether a test will consistently produce the same or similar results over repeated measures. That said, if the instruments used to identify learning styles do not meet the criteria for robust reliability and validity, then the results of those tests could not be used with confidence to establish relationships between variables. This conclusion was similarly reiterated by Cassidy (2004) where the twenty-four most common instruments used to identify learning or cognitive styles were analyzed. Cassidy concluded there were many overlaps and similarities between the different instruments resulting in a lack of explicit information needed to draw any conclusions about the effects of such styles on learning—the absence of reliability and validity data notwithstanding.

Myron Dembo, an esteemed educational psychologist and Emeritus Professor of Educational Psychology, stated "any usefulness that might be derived from applying learning styles must be substantiated by valid and reliable instruments" (Dembo & Howard, 2007, p. 103). He concludes, furthermore, that "there is no benefit to matching instruction to preferred learning style, and there is no evidence that understanding one's learning style improves learning and its related outcomes" (p.107).

Although the visual, aural, and kinesthetic (VAK) learning styles are unquestionably the most familiar, research has identified *over 71 different types of learning styles* which have been categorized into 13 models and families (Learning Styles and Pedagogy in Post-16 Learning: A Systematic and Critical Review, 2004). Due to the low validity and reliability scores of the instruments used to identify specific learning styles, however, there are serious doubts about their psychometric properties (Coffield, Moseley, Hall, & Ecclestone, 2004; Liu, Ginther, & Ginther, 1999; Penger, Tekavčič, & Dimovski, 2008). This lack of reliability and validity of the instruments used to identify learning styles has been supported by Curry (1990). He claims that there are three basic problems associated with the use of instruments used to identify learning styles: (1) confusion in definitions of learning styles, (2) weaknesses in reliability and validity, and (3) the identification of relevant characteristics in instructional settings, or aptitude-treatment interactions.

Curry's conclusion has also been echoed in a comprehensive literature review conducted by Professor Thomas Reeves, of the University of Georgia, entitled *Do Generational Differences Matter in Instructional Design?* (Reeves, 2006). In his literature review, Reeves stated that the weaknesses found in learning styles research throws grave doubt on the validity and utility of employing learning styles as a basis for accommodating students of any generation (Coffield, et al., 2004).

The problem confronting learning style research are numerous *uncontrolled* variables affect performance, e.g., intervening /confounding variables, that cannot be identified, and any attempt to isolate variables requires a robust multivariate experimental design. To that end, most learning style instruments have such serious weaknesses (e.g. low reliability & poor validity) that investigations of the

properties of a variety of scales have revealed that even the most widely used are inadequate in this regard (Scott, 2010).

Learning Styles vis-à-vis Learning Modalities

There is substantial confusion between the terms *learning modalities* and *learning styles;* these are often used interchangeably. Learning or cognitive styles are *habitual ways of processing information to memory.*   They are the *ways* one senses, thinks, solves problems, and remembers information. In contrast, *learning modalities*, refer to one's senses: *visual*, *auditory*, and *tactile (including kinesthetic)*. Neuroscience, however, has revealed that "ninety percent of learning is visual with eighty-five percent of the brain wired for visual processing" (Lucas, 2004, pp 8, as cited in Clemons, 2005); one's *primary* learning modality, therefore, is *visual*.

The most significant variable in terms of one's retention of learning is one's attachment of meaning to what is learned. Retention is generally independent of the modality used to acquire whatever is learned (Willingham, 2005). Nevertheless, it should be noted that retention can be reinforced to some degree when learning occurs through a combination of text and images rather than through text alone (Mayer & Moreno, 2003). Furthermore, adding images to verbal (textual or auditory) learning can result in significant gains in basic and higher-order learning (Multimodal Learning Through Media…, 2008).

Unquestionably, some individuals excel over others at aural, visual, or kinesthetic tasks. But our brain does not work in a way that differentiates types of information received through the senses. The brain seeks for meaning, pattern interconnectedness, relevance, and usefulness of applications (Greenleaf, 2003). It does this by storing information into memory *collectively*, not *separately*. With respect to working memory, verbal/text memory and visual/spatial memory work together, without interference, into a framework (or *schema*) of understanding. Consequently, the development of schemata requires students to learn topics in ways that are relevant and meaningful to them, regardless of the modality (Multimodal Learning Through Media: What the Research Says, 2008). This is supported by Clark and Mayer (2011) where they state, according to the cognitive theory of multimedia learning, that "all people have separate channels for processing verbal and pictorial material", and "learners actively attempt to build pictorial and verbal models from the presented material and build connections between them" (p. 121).

Differentiation Between Learning Styles and Cognitive Styles

Research has revealed a wide disparity in the definition of *learning styles* and their relationship to *cognitive styles*. The term *cognitive style* has been introduced and reintroduced into psychological literature since the writings of the German psychologists at the turn of the century. The term has been used most recently to denote consistencies in individual modes of functioning in a variety of behavioral situations. Specifically, cognitive style refers to the preferred way one processes information (Kagan, Moss, & Sigel, 1963). It is viewed as a bipolar dimension representing one's typical or *habitual* mode

of problem-solving, thinking, perceiving. and remembering; it is considered stable over time, and is re-lated to theoretical or academic research (Cognitive/Learning Styles, n.d.).

Although there are numerous definitions of *learning styles*, the more common ones see these styles as being "multidimensional." They are generally not "either-or" extremes. They are character-ized by how information is preferentially perceived (sensory or intuitive), organized (inductive or deduc-tive), processed (active or reflective), and received (visual, aural, or kinesthetic). In other words, a learning style or modality describes how information enters the brain: visually, aurally, or tactically, whereas cognitive style refers to how the information is processed once the information gets to the brain. Perhaps the most cited definition is by Keefe (1979) who defines "learning styles [as] the com-posite of characteristic cognitive, affective, and physiological factors that serve as relatively stable in-dicators of how a learner perceives, interacts with, and responds to the learning environment" (as cited in Merrill, 2000).

Aptitude Treatment Interaction (ATI)

Beginning in the early 60's, Lee Cronbach and Richard Snow searched "fruitlessly for interac-tions of abilities" by looking for *aptitudes* (characteristics that affects responses to the treatment) that explained how to instruct students one way and not another, i.e., evidence that showed regression slopes that differed from treatment to treatment. Continuing through the 70's and mid 80's, Cronbach and Snow continued their research by advocating closer scrutiny of cognitive processes by focusing on Aptitude Treatment Interactions (Learning Orientation Research: Individual Differences in Learning, 2004).

The concept of ATI is that some instructional strategies (treatments) are more or less effective for particular individuals depending upon their specific abilities. Snow (1980) made a distinction be-tween aptitude processes, e.g., those predictable, directed changes in psychological functioning by which individuals learn, and cognitive style, which elicits a stylistic or strategic behavior from the indi-vidual.

As a theoretical framework, ATI suggests that optimal learning results when the instruction is matched to the aptitudes of the learner. It is consistent with theories of intelligence that suggest a multidimensional view of ability. The aim of ATI research is to predict educational outcomes from com-binations of aptitudes and treatments. However, the lack of attention to the social aspects of learning is a serious deficiency of ATI research (Aptitude Treatment Interaction, n.d.).

Cronbach's research emphasized the important relationship between cognitive aptitudes and treatment interactions, but was continually thwarted by inconsistent findings from similar inquiries. Successive studies employing the same treatment variable found different outcome-on-aptitude slopes. Cronbach concluded the *inconsistency came from unidentified interactions* and that "an un-derstanding of cognitive abilities considered alone would not be sufficient to explain learning, individu-al differences in learning, and aptitude treatment interactions" (Learning Orientation Research, 2004). Eventually the new *aptitudes* evolved into *cognitive styles* to represent the predominant modes of in-

formation processing, although can very within individuals as a function of task and situation variables (Aptitude Treatment Interaction, n.d.).

GENERATIONAL DIFFERENCES

In a similar way that the concept of "learning styles" has led many instructional designers to select media based largely on a misperceived relationship with learning outcomes, the more recent focus on *The Digital Generation*, is also proving itself to be misleading. In a recent issue of Chronicle of Higher Education (CHE), in its *The Millennial Muddle* article, Palmer Muntz, director of admissions at Lincoln Christian University is said to have asserted that "To accept generational thinking, one must find a way to swallow two large assumptions. That tens of millions of people, born over about 20 years, are fundamentally different from people of other age groups—and that those tens of millions of people are similar to each other in meaningful ways" (as cited in Hoover, 2009. The same article reports that the University of California at Los Angeles' Cooperative Institutional Research Program, which has conducted annual surveys since 1966, shows changes are small and gradual—and differences are not significant between generations, but only over multiple generations. Some disturbing trends that were over multiple generations were noted, however: an increasing sense of entitlement, decreasing literacy, and general factual knowledge.

In its September 2008 issue, The CHE published an article entitled *Generational Myth*. Its author, Professor Siva Vaidhyanathan (2008), claimed that there is no "Digital Generation.' Today's young people—including college students—are just more complicated than any analysis of imaginary generations can ever reveal". The article went on to say those focusing on those "born digital" ignore the "vast range of skills, knowledge, and experience of many segments of society, and ignores the needs of the those who are not socially or financially privileged." Professor Vaidhyanathan claims that familiarity with, understanding of, and dexterity with technology varies greatly within the 18-23 age group. While a few have amazing skills, a large number can't deal with computers, consequent, one must avoid *overestimating the digital skills of young people in general*. Thinking in generations is too simplistic. The article goes on to state that "Once we assume that all young people love certain forms of interaction and hate others, we forge policies and design systems and devices that match those predispositions. By doing so, we either pander to some marketing cliché or force otherwise diverse group of potential users into a one size-fits-all system might not meet their needs."

In another CHE article, Bauerlein (2008) claims that "The greatest disappointment of our time is that huge investments made in technology (beginning with Telecommunications Act of 1996) in public schools have met with negative results. In fact, he reports, reading proficiency dropped from 40% to 35% from 1992 to 2005". Addressing the use of the new popular technologies and applications, Bauerlein claims that leisure-time technical skills did not translate to educational and training use of technology. Intellectual habits such as deep reflection decrease with increase time spent on browsing, blogging, Instant Messaging, Twittering, and Facebooking. *Fast scanning does not translate into academic reading*. So it appears that the learner's familiarity with technology does not indicate how well he or she will perform in a distance learning environment. Our main point for designers is that they

should not be distracted by whether their learners are part of a so-called Digital Generation, but instead should focus on designing instruction based on sound cognitive learning strategies.

The above conclusion has also been echoed in a comprehensive literature review conducted by Professor Thomas Reeves of the University of Georgia entitled *Do Generational Differences Matter in Instructional Design?* (Reeves, 2006). In his literature review, Reeves addressed whether generational difference is a variable important enough to be considered during the design of instruction or the use of different educational technologies. Reeves concluded the weight of the evidence is negative. Although generational differences are evident in the workplace, *they are not salient enough to warrant the specification of different instructional designs or the use of different learning technologies.* Reeves also stated that research on generational differences suffers from many of the same weaknesses found in learning styles research and throws grave doubt on the validity and utility of employing learning styles as a basis for accommodating students of any generation (Coffield, et al.,2004).

In his conclusion, Reeves stated in the light of the weak nature of generational differences as a measurable construct, that any quasi-experimental studies aimed at determining the effectiveness of different instructional designs or educational technologies across generations are not needed. Instead of worrying about whether Boomers, GenXers or Millennials will learn more from direct instruction or virtual reality games, instructional designers and educational technology researchers working closely with practitioners and subject matter experts should begin by identifying the needs of any given set of learners, design the best possible prototype learning environments *in situ*, and then conduct iterative cycles of formative evaluation and refinement to optimize the solution and reveal robust design principles (Hoover, 2009).

CONCLUSION

The human dynamics of learning are a complex, multi-dimensional process, with cognitive science revealing that learners differ in their abilities with different modalities. Teaching to a learner's best modality, however, does not affect his or her educational achievement. What does matter is whether the learner is taught in the *content's* best modality (Willingham, 2005); learning is facilitated when content drives the choice of modality. Furthermore, learning styles provide no indication of what the students are capable of, nor are they legitimate excuses for poor academic performance.

If a focus on learning styles does not work, what does work? Through the systematic design of instruction, integrating cognitive learning strategies that help learners link new information to prior knowledge should be a fundamental consideration. Myron Dembo, Emeritus Professor of Educational Psychology, may have summed it up best when he stated that educational research supports the teaching of learning strategies that contain scaffolding features and tailored instruction for different levels of prior knowledge (Dembo & Howard, 2007). This focus on instructional strategies is also supported by David M. Merrill (2000), who concludes that "learning style is secondary in selecting the fundamental components of instructional strategy appropriate for and consistent with a given learning goal" (p. 4).

On a final note, the research on how we learn has generally ignored the our agility in adapting to different learning environments. We have an intrinsic desire and ability to learn, although some of us are more adept than others. Thusly, we must recognize the complexity in learning and that individuals do learn differently. Learning style research, regrettably, has exhibited a tendency to "profile" learners into specific categories, and consequently has understated our individual potential to employ multiple learning "preferences" in our endeavor to learn. Consequently, we, as educators, must never underestimate the learning variable that "trumps" all other variables ...*the will to learn*.

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