

REVIEWS

Learning Styles: A Review of Theory, Application, and Best Practices

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Much pedagogical research has focused on the concept of “learning styles.” Several authors have proposed that the ability to typify student learning styles can augment the educational experience. As such, instructors might tailor their teaching style so that it is more congruent with a given student’s or class of students’ learning style. Others have argued that a learning/teaching style mismatch encourages and challenges students to expand their academic capabilities. Best practice might involve offering courses that employ a variety of teaching styles. Several scales are available for the standardization of learning styles. These scales employ a variety of learning style descriptors and are sometimes criticized as being measures of personality rather than learning style. Learning styles may become an increasingly relevant pedagogic concept as classes increase in size and diversity. This review will describe various learning style instruments as well as their potential use and limitations. Also discussed is the use of learning style theory in various concentrations including pharmacy.

INTRODUCTION

The diversity of students engaged in higher education continues to expand. Students come to colleges with varied ethnic and cultural backgrounds, from a multitude of training programs and institutions, and with differing learning styles.¹ Coupled with this increase in diversification has been a growth in distance education programs and expansions in the types of instructional media used to deliver information.^{2,3} These changes and advances in technology have led many educators to reconsider traditional, uniform instruction methods and stress the importance of considering student learning styles in the design and delivery of course content.⁴⁻⁵ Mismatches between an instructor’s style of teaching and a student’s method of learning have been cited as potential learning obstacles within the classroom and as a reason for using a variety of

teaching modalities to deliver instruction.⁶⁻⁸ The concept of using a menu of teaching modalities is based on the premise that at least some content will be presented in a manner suited to every type of learner within a given classroom or course. Some research has focused on profiling learning types so that instructors have a better understanding of the cohort of students they are educating.⁷⁻⁸ This information can be used to guide the selection of instruction modalities employed in the classroom. Limited research has also focused on describing and characterizing composite learning styles and patterns for students in various concentrations of study (eg, medicine, engineering).^{5,6,9} This review will describe the potential utility and limitations in assessing learning styles.

LEARNING STYLES

A benchmark definition of “learning styles” is “characteristic cognitive, effective, and psychosocial behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment.”¹⁰ Learning styles are considered by many to be one factor of success in higher education. Confounding research and, in many instances, application of learning style theory has begat the myriad of methods used to categorize learning styles. No single commonly accepted method currently exists, but alternatively several potential scales and classifications are in use. Most of these scales and classifications are more similar than dissimilar and focus on environmental preferences, sensory modalities, personality types, and/or cognitive styles.¹¹ Lack of a conceptual framework for both learning style theory and measurement is a common and central criticism in this area. In 2004 the United Kingdom Learning and Skills Research Center commissioned a report intended to systematically examine existing learning style models and instruments. In the commission report, Coffield et al identified several inconsistencies in learning style models and instruments and cautioned educators with regards to their use.¹² The authors also outlined a suggested research agenda for this area.

Alternatively, many researchers have argued that knowledge of learning styles can be of use to both educators and students. Faculty members with knowledge of

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learning styles can tailor pedagogy so that it best coincides with learning styles exhibited by the majority of students.⁴ Alternatively, students with knowledge of their own preferences are empowered to use various techniques to enhance learning, which in turn may impact overall educational satisfaction. This ability is particularly critical and useful when an instructor's teaching style does not match a student's learning style. Compounding the issue of learning styles in the classroom has been the movement in many collegiate environments to distance and/or asynchronous education.^{2,3} This shift in educational modality is inconsistent with the learning models with which most older students and adult learners are accustomed from their primary and high school education.^{3,13,14} Alternatively, environmental influences and more widespread availability of technological advances (eg, personal digital assistants, digital video, the World Wide Web, wireless Internet) may make younger generations of students more comfortable with distance learning.¹⁵⁻¹⁷

LEARNING STYLES INSTRUMENTS

As previously stated, several models and measures of learning styles have been described in the literature. Kolb proposed a model involving a 4-stage cyclic structure that begins with a concrete experience, which lends to a reflective observation and subsequently an abstract conceptualization that allows for active experimentation.¹⁸ Kolb's model is associated with the Learning Style Inventory instrument (LSI). The LSI focuses on learner's preferences in terms of concrete versus abstract, and action versus reflection. Learners are subsequently described as divergers, convergers, assimilators, or accommodators.

Honey and Mumford developed an alternative instrument known as the Learning Style Questionnaire (LSQ).⁶ Presumably, the LSQ has improved validity and predictive accuracy compared to the LSI. The LSQ describes 4 distinct types of learners: activists (learn primarily by experience), reflectors (learn from reflective observation), theorists (learn from exploring associations and interrelationships), and pragmatics (learn from doing or trying things with practical outcomes). The LSQ has been more widely used and studied in management and business settings and its applicability to academia has been questioned.⁶ An alternative to the LSQ, the Canfield Learning Style Inventory (CLSI) describes learning styles along 4 dimensions.¹⁹ These dimensions include conditions for learning, area of interest, mode of learning, and conditions for performance. Analogous to the LSQ, applicability of the CLSI to academic settings has been questioned. Additionally, some confusion surrounding scoring and interpretation of certain result values also exists.

Felder and Silverman introduced a learning style assessment instrument that was specifically designed for classroom use and was first applied in the context of engineering education.²⁰ The instrument consists of 44 short items with a choice between 2 responses to each sentence. Learners are categorized in 4 dichotomous areas: preference in terms of type and mode of information perception (sensory or intuitive; visual or verbal), approaches to organizing and processing information (active or reflective), and the rate at which students progress towards understanding (sequential or global). The instrument associated with the model is known as the Index of Learning Survey (ILS).²¹ The ILS is based on a 44-item questionnaire and outputs a preference profile for a student or an entire class. The preference profile is based on the 4 previously defined learning dimensions. The ILS has several advantages over other instruments including conciseness and ease of administration (in both a written and computerized format).^{20,21} No published data exist with regards to the use of the ILS in populations of pharmacy students or pharmacists. Cook described a study designed to examine the reliability of the ILS for determining learning styles among a population of internal medicine residents.²⁰ The researchers administered the ILS twice and the Learning Style Type Indicator (LSTI) once to 138 residents (86 men, 52 women). The LSTI has been previously compared to the ILS by several investigators.^{8,19} Cook found that the Cronbach's alpha scores for the ILS and LSTI ranged from 0.19 to 0.69. They preliminarily concluded that the ILS scores were reliable and valid among this cohort of residents, particularly within the active-reflective and sensing-intuitive domains. In a separate study, Cook et al attempted to evaluate convergence and discrimination among the ILS, LSI, and another computer-based instrument known as the Cognitive Styles Analysis (CSA).¹¹ The cohort studied consisted of family medicine and internal medicine residents as well as first- and third-year medical students. Eighty-nine participants completed all 3 instruments, and responses were analyzed using calculated Pearson's *r* and Cronbach's α . The authors found that the ILS active-reflective and sensing-intuitive scores as well as the LSI active-reflective scores were valid in determining learning styles. However, the ILS sequential-global domain failed to correlate well with other instruments and may be flawed, at least in this given population. The authors advised the use of caution when interpreting scores without a strong knowledge of construct definitions and empirical evidence.

Several other instruments designed to measure personality indexes or psychological types may overlap and describe learning styles in nonspecific fashions. One example of such an indicator is the Myers-Briggs Index.⁶

While some relation between personality indexes and learning styles may exist, the use of instruments intended to describe personality to characterize learning style has been criticized by several authors. Therefore, the use of these markers to measure learning styles is not recommended.⁶ The concept of emotional intelligence is another popular way to characterize intellect and learning capacity but similarly should not be misconstrued as an effective means of describing learning styles.²³

CULTURE

Several authors have proposed correlations between culture and learning styles.^{6,24} This is predicated on the concept that culture influences environmental perceptions which, in turn, to some degree determine the way in which information is processed and organized. The storage, processing, and assimilation methods for information contribute to how new knowledge is learned. Culture also plays a role in conditioning and reinforcing learning styles and partially explains why teaching methods used in certain parts of the world may be ineffective or less effective when blindly transplanted to another locale.^{6,24} Teachers should be aware of this phenomenon and the influence it has on the variety of learning styles that are present in classrooms. This is especially true in classrooms that have a large contingency of international students. Such classrooms are becoming increasingly common as more and more schools expand their internationalization efforts.²⁵

The technological age may also be influencing the learning styles of younger students and emerging generations of learners. The Millennial Generation has been described as more technologically advanced than their Generation X counterparts, with higher expectations for the use of computer-aided media in the classroom.^{15,16,26} Younger students are accustomed to enhanced visual images associated with various computer- and television-based games and game systems.^{16,26} Additionally, video technology is increasingly becoming “transportable” in the way of mobile computing, MP3 devices, personal digital video players, and other technologies.²⁶ All of these advances have made visual images more pervasive and common within industrialized nations.

APPLYING LEARNING STYLES TO THE CLASSROOM

As class sizes increase, so do the types and numbers of student learning styles. Also, as previously mentioned, internationalization and changes in the media culture may affect the spectrum of classroom learning styles as well.^{24,25} Given the variability in learning styles that may exist in a classroom, some authors suggested that students

should adapt their learning styles to coincide with a given instruction style.^{6,27} This allows instructors to dictate the methods used to instruct in the classroom. This approach also allows instructors to “teach from their strengths,” with little consideration to other external factors such as learning style of students. While convenient, this unilateral approach has been criticized for placing all of the responsibility for aligning teaching and learning on the student. When the majority of information is presented in formats that are misaligned with learning styles, students may spend more time manipulating material than they do in comprehending and applying the information. Additionally, a unilaterally designed classroom may reinforce a “do nothing” approach among faculty members.⁶ Alternatively, a teaching style-learning style mismatch might challenge students to adjust, grow intellectually, and learn in more integrated ways. However, it may be difficult to predict which students have the baseline capacity to adjust, particularly when significant gaps in knowledge of a given subject already exist or when the learner is a novice to the topic being instructed.^{6,27} This might be especially challenging within professional curricula where course load expectations are significant.

Best practice most likely involves a teaching paradigm which addresses and accommodates multiple dimensions of learning styles that build self-efficacy.²⁷ Instructing in a way that encompasses multiple learning styles gives the teacher an opportunity to reach a greater extent of a given class, while also challenging students to expand their range of learning styles and aptitudes at a slower pace. This may avoid lost learning opportunities and circumvent unnecessary frustration from both the teacher and student. For many instructors, multi-style teaching is their inherent approach to learning, while other instructors more commonly employ unilateral styles. Learning might be better facilitated if instructors were cognizant of both their teaching styles and the learning styles of their students. An understanding and appreciation of a given individual’s teaching style requires self-reflection and introspection and should be a component of a well-maintained teaching portfolio. Major changes or modifications to teaching styles might not be necessary in order to effectively create a classroom atmosphere that addresses multiple learning styles or targets individual ones. However, faculty members should be cautious to not over ambitiously, arbitrarily, or frivolously design courses and activities with an array of teaching modalities that are not carefully connected, orchestrated, and delivered.

Novice learners will likely be more successful when classrooms, either by design or by chance, are tailored to their learning style. However, the ultimate goal is to instill

within students the skills to recognize and react to various styles so that learning is maximized no matter what the environment.²⁸ This is an essential skill for an independent learner and for students in any career path.

Particular consideration of learning styles might be given to asynchronous courses and other courses where a significant portion of time is spent online.²⁹ As technology advances and classroom sizes in many institutions become increasingly large, asynchronous instruction is becoming more pervasive. In many instances, students who have grown accustomed to technological advances may prefer asynchronous courses. Online platforms may inherently affect learning on a single dimension (visual or auditory). Most researchers who have compared the learning styles of students enrolled in online versus traditional courses have found no correlations between the learning styles and learning outcomes of cohorts enrolled in either course type. Johnson et al compared learning style profiles to student satisfaction with either online or face-to-face study groups.³⁰ Forty-eight college students participated in the analysis. Learning styles were measured using the ILS. Students were surveyed with regard to their satisfaction with various study group formats. These results were then correlated to actual performance on course examinations. Active and visual learners demonstrated a significant preference for face-to-face study groups. Alternatively, students who were reflective learners demonstrated a preference for online groups. Likely due to the small sample size, none of these differences achieved statistical significance. The authors suggest that these results are evidence for courses employing hybrid teaching styles that reach as many different students as possible. Cook et al studied 121 internal medicine residents and also found no association ($p > 0.05$) between ILS-measured learning styles and preferences for learning formats (eg, Web-based versus paper-based learning modules).³¹ Scores on assessment questions related to learning modules administered to the residents were also not statistically correlated with learning styles.

Cook et al examined the effectiveness of adapting Web-based learning modules to a given learner's style.³² The investigators created 2 versions of a Web-based instructional module on complementary and alternative medications. One version of the modules directed the learner to "active" questions that provided learners immediate and comprehensive feedback, while the other version involved "reflective" questions that directed learners back to the case content for answers. Eighty-nine residents were randomly matched or mismatched based on their active-reflective learning styles (as determined by ILS) to either the "active" or "reflective" test version.

Posttest scores for either question type among mismatched subjects did not differ significantly ($p = 0.97$), suggesting no interaction between learning styles and question types. The authors concluded from this small study that learning styles had no influence on learning outcomes. The study was limited in its lack of assessment of baseline knowledge, motivation, or other characteristics. Also, the difficulty of the assessment may not have been sufficient enough to distinguish a difference and/or "mismatched" learners may have automatically adapted to the information they received regardless of type.

STUDIES OF PHARMACY STUDENTS

There are no published studies that have systematically examined the learning styles of pharmacy students. Pungente et al collected some learning styles data as part of a study designed to evaluate how first-year pharmacy students' learning styles influenced preferences toward different activities associated with problem-based learning (PBL).³³ One hundred sixteen first-year students completed Kolb's LSI. Learning styles were then matched to responses from a survey designed to assess student preferences towards various aspects of PBL. The majority of students were classified by the LSI as being accommodators (36.2%), with a fairly even distribution of styles among remaining students (19.8% assimilators, 22.4% convergers, 21.6% divergers). There was a proportional distribution of learning styles among a convenience sample of pharmacy students. Divergers were the least satisfied with the PBL method of instruction, while convergers demonstrated the strongest preference for this method of learning. The investigators proposed that the next step might be to correlate learning styles and PBL preferences with actual academic success.

CONCLUSION

Limited research correlating learning styles to learning outcomes has hampered the application of learning style theory to actual classroom settings. Complicating research is the plethora of different learning style measurement instruments available. Despite these obstacles, efforts to better define and utilize learning style theory is an area of growing research. A better knowledge and understanding of learning styles may become increasingly critical as classroom sizes increase and as technological advances continue to mold the types of students entering higher education. While research in this area continues to grow, faculty members should make concentrated efforts to teach in a multi-style fashion that both reaches the greatest extent of students in a given class and challenges all students to grow as learners.

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