

Application of learning styles in medical education – A review

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Abstract

Understanding the concept of 'learning styles' has received special attention, more so recently with attempts to standardize medical educational technologies. Several studies have shown that focusing on student learning styles can enhance educational outcomes. Therefore instructors find it fruitful to match their teaching methods or styles to embrace multiple learning styles present in a given group of students. Some researchers feel that adult learners will be able to develop their own learning styles with the help of knowledge outlined by the instructor. Medicine with multiple domains of learning has automatically involved many teaching/learning styles since time immemorial. There have been several methods of classification of learning styles. Many methods include personality traits along with learning behavior. Learning styles now assume greater importance with globalization extending into medical schools resulting in increased student number and diversity. This review describes the various methods available to measure learning styles and the principles behind the same.

Key words: classification, learning styles, students, teaching styles

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Introduction

The term, 'learning style' describes an individual's preferred method of gathering, processing, interpreting, organizing and analyzing information.¹ Medical students come from diverse linguistic, cultural, social and educational backgrounds. They have been exposed to varying instructional methods and media in the pre-med curriculum.² The phenomenal explosion in medical knowledge coupled with the rapid advancement in technology has prompted educators to review the traditional teaching learning methods.^{3,4} There is increasing awareness among teachers to modify their teaching styles to accommodate individual learning styles to maximize teaching outcomes. This becomes more challenging in large group teaching learning methods. Mismatch between student learning styles and instruction methods have been cited to result in

ineffective teaching.^{5,6} Reasons for using a variety of methods during any teaching ritual is based on the concept that needs of every type of learner is addressed to some extent.^{7,8} Various studies have emphasized on doing a needs assessment on the learning styles of the student cohort involved.⁹ This can be valuable in designing the compatible teaching learning methods. Medical students need to develop composite learning styles since the curriculum embraces a myriad of learning domains and environments.¹⁰ This review describes the principles involved in the application of various learning styles to meet the special demands of the medical curriculum. The review starts with a brief description of the early history of learning styles and student diversity. The application of learning styles to classrooms is discussed with the classification of learning styles under four different headings of

student roles and behaviors, types of learners, learning components and principles of learning.

Early History

Alfred Binet, a French psychologist, in 1904, developed the first intelligence test, which created interest in individual learning methods.¹¹ Dr. Maria Montessori, the pioneer in the Montessori method of education, in 1907 began using methods to enhance the learning styles of her students.¹² Dr. Montessori proposed that students exhibit mastery of subjects not just by evaluation of theoretical knowledge but also through their actions. There was a perceptible slackening in the study of learning styles till the 1950's. This was due to more emphasis given to Intelligent Quotient and academic achievement. In 1956, Benjamin Bloom developed the Bloom's Taxonomy, which helped defining learning-style differences based on increasing hierarchy of knowledge processing skills.¹³ Isabel Myers-Briggs and Katherine Briggs developed the Myers-Briggs Type Indicator (MBTI) in 1962.¹⁴

Further progress was made when the Dunn and Dunn Learning Style Model¹⁵ was introduced in 1976 including evaluation techniques for learning styles. The Dunn model suggested a holistic approach to the investigation into learning styles. Five key dimensions were identified on which student learning styles varied. These dimensions were environmental, emotional support, sociological composition, physiological and psychological elements.

In 1984, David Kolb published his learning-style model,¹⁶ where he proposed that learning styles are closely determined by cognitive skills. In the past two decades there has been awareness on the instructor's need to address learning styles in the classroom through modifications in the curriculum that includes multiple styles, to provide equal chance for all students to learn.

Student diversity and learning styles

Several studies have shown correlations between culture and learning styles.¹⁷ This is based on the concept that cultural backgrounds influence the way in which information is processed as knowledge. This prior knowledge is vital for taking in new information and development of concepts. In India with students enrolled in medical schools from diverse parts of the country as well as other nations blind application of teaching strategies destined for one group may be ineffective in another group.

Advancement in technology has definitely influenced the learning styles of the present generation of students. The millennial generation is more computer savvy compared to students of generation X expect more application of multimedia in teaching.¹⁸ The newer medical entrants are more used to visual images of television and computer based games. In addition video technology is easily available on demand by way of mobile phones and personalized laptops.¹⁹ Hence learning through visual images has made inroads even in developing nations.

Applying learning styles to classrooms

A discussion of classification of learning styles can be done under the following headings: student roles and behaviors, types of learners, learning components and principles of learning.

1. Student roles and behaviors

The theory of 'Multiple intelligence' was proposed by Dr. Gardner since he felt that intelligent quotient as measure of intelligence was not adequate. The conclusions of Gardner's theory are that each intelligence can be symbolized, b) each intelligence has its own developmental history, c) each intelligence is represented by and vulnerable to lesions in specific parts of the brain, and d) each intelligence has its own culturally valued end state.²⁰⁻²²

He has proposed, to date, nine different intelligences to account for a broader range of human intelligence potential in children and adults. These intelligences are:

- 1) linguistic intelligence ("word smart"),
- 2) logical-mathematical intelligence ("number/reasoning smart"),
- 3) spatial intelligence ("picture smart"),
- 4) bodily-kinesthetic intelligence ("body smart"),
- 5) musical intelligence ("music smart"),
- 6) interpersonal intelligence ("people smart"),
- 7) intrapersonal intelligence ("self smart"),
- 8) naturalist intelligence ("nature smart"), and
- 9) existential intelligence ("'big picture' smart").

The multiple intelligence theory based preference of learning styles was studied in a group of undergraduate pathology students.²³ The results indicated that the strategies being used by the instructor were in tune with the preferred intelligences of approximately one third of the class.

The use of analogy and metaphor, concept mapping, small group discussion, creating tables and drawing that had been consciously incorporated by the instructor indicated a conscious application of principles of linguistic intelligence, logical-mathematical intelligence, spatial intelligence, and interpersonal intelligence. The potentials of other forms of multiple intelligences such as bodily-kinesthetic intelligence, musical intelligence and intrapersonal intelligence were not tapped in the teaching methods though there was scope for their application in pathology. But student's survey revealed that one third of the class showed a preference for the latter group of intelligences. Therefore this group of students could be disconnected from the process of learning although there was no overall difference in their academic performance. However, insight of this knowledge was beneficial to the instructor in reviewing the teaching learning methods for the subsequent group of students.

The Myers Briggs Type Indicator (MBTI) identifies one's preferences for ways of taking in and processing information, this describes aspects of both personality and learning style.²⁴ Personality reveals the mental make-up of a person and how they are able to relate to others. It is therefore natural that the manner in which a learner relates to the world is obviously going to impact his learning style or the preference for learning about the world. Paying attention to the natural learning preferences can greatly influence understanding, retention and retrieval of information. Observation of variations in learning styles in relation to personality therefore assumes importance.

Meyer and Briggs divided personality into four categories, - attitudes, perceiving function, decision making and structure or openness.²⁴ Each of these were further characterized into 2 – attitude as introvert or extrovert [I or E], perceiving function as sensing or intuition [S or N], decision making as thinking or feeling [T or F] structure or openness as judging or perceiving [J or P].²⁴ Sixteen personality types were proposed based on various combinations of the above characteristics.

In a study on undergraduate medical students showed that the most frequently occurred learning style was ENTP which was similar with the study conducted on pharmacy students.^{25,26} This shows that undergraduate medical students were extroverts,

relied on intuition more, thought more rather than feeling about an experience and just perceived more instead of forming conclusions. The study also concluded that ENTP, INFP, INTP, ENFJ were the most common four personalities found. The inferences that can be drawn are undergraduates mostly rely on intuition and there are equal number of extroverts and introverts. Again an equal number of students fall in the thinking or feeling category but only about twenty five percent are interested in judging information. Interestingly in a comparative study on the personality based learning styles among Indian and non Indian students, the non Indian students relied on sensing rather than intuition and preferred judging than just perceiving compared to their Indian counterparts.²⁷

The above studies on the various Myer Briggs personality types among medicos which help us determine their learning patterns and their matching teaching strategies. An extrovert will have good leadership qualities and presentation skills, whereas an introvert may be good at individual project work. Similarly a student with good intuition may have good diagnostic skills but a sensing individual can think of a multitude of options for differential diagnosis. A thinking person is good at understanding the steps in core concepts and a feeling person can express concepts as visual images. Likewise career options also suit certain personality types. An extrovert can do well in psychiatry while an introvert can make a competent pathologist. It is important to remember that no personality type is inferior or superior. But understanding of variations in learning styles due to inherent personality differences can help instructors customize teaching as per individual needs. Mentoring students with objective can also be extended to guide career choices.

2. Types of learners

Learning styles can also be based on the dominant senses for perceiving information whether visual, auditory or kinesthetic. The VARK model which was proposed by Fleming and Mills classifies learner based on the sensory modalities preferentially involved in assimilating information.²⁸ VARK is an acronym for the Visual (V), Auditory (A), Read/Write (R) and the Kinesthetic (K) sensory modalities. The visual learners process the information best if they can see it. The auditory learners like to hear information. The read-write learners prefer to see

the written words. The kinesthetic learners like to acquire information through experience and practice.

According to the VARK model, a students' learning style' depends on how he or she prefers to perceive/receive information. They may prefer a single mode (unimodal), two modes (bimodal), three modes (trimodal) or all four modes (quadrimodal) of information gathering. In a study of learning styles among first year medical students it was found that 61% students had multimodal learning style preferences and that only 39% students had unimodal preferences.²⁹ Amongst the multimodal learning styles, the most preferred mode was bimodal, followed by trimodal and quadrimodal respectively.

In a study among undergraduate students on learning Physiology showed gender differences in learning styles. Females preferred visual learning (46%) followed by aural (27%), read/write (23%), and kinesthetic (4%).³⁰ There was change in the order of preference for males were 49% preferred visual learning, followed by read/write (29%), aural (17%), and kinesthetic (5%). There was also a significant relationship between preferred sensory modality and course scores.³¹ The aural learners appeared to get better course scores compared to kinesthetic learners. The authors further concluded that teaching physiology was effective when an instructor used multiple modes for presentation and then emphasized on individual preferred style.

Approaches and Study Skills Inventory for Students (ASSIST) is another tool which has been widely employed to determine learning styles of students.³² The items in this questionnaire have been categorized as three groups of learning – deep, strategic and surface approaches. This instrument has been used to study the variation in learning styles among postgraduate and undergraduate medical students and also undergraduate students belonging to different years

In a study using the VARK as well the ASSIST questionnaire suggested that learning approaches and styles differed among medical undergraduates as well as undergraduates and post graduates.³³ In postgraduate students, the approach suggested a positive shift towards deep and strategic learning. But a similar change was not evident in undergraduate students during their progress from first year to final year. The validity of ASSIST as a valuable measure of learning styles concluded that

recognition of student's learning approach is vital.³⁴ Since education is a key factor in the development of an individual, focus on learning styles should form the fulcrum of any curricular design.

3. Learning components

Learning components can be classified into three levels. The first is the cognitive component or what the student should learn. Next is the affective element which decides what motivates a student to learn. Lastly the meta-cognitive element is about how to learn, identify and correct areas of deficit. This hierarchy of learning has been largely incorporated in Bloom's taxonomy. Developed in 1956, Bloom's Taxonomy¹³ classified learning styles into six distinct levels of cognitive thinking: knowledge, comprehension, application, analysis, synthesis and evaluation. Bloom's structure was designed in the shape of a pyramid, with knowledge on the bottom as the foundation and evaluation at its peak. The Bloom's taxonomy is more popularly used for writing of learning objectives, curriculum design, choosing appropriate teaching learning and evaluation methods. But since it describes the stepwise progress in knowledge acquisition methods, it also becomes a valuable tool both for instructors and students to evaluate the learning preferences. This will help to promote better teaching methods needed for critical and creative thinking.

David Kolb published his learning styles model in 1984 from which he developed his learning style inventory. Much of Kolb's theory is concerned with the learner's internal cognitive processes. In Kolb's theory, the impetus for the development of new concepts is provided by new experiences. Kolb's experiential learning theory works on two levels: a four stage cycle of learning and four separate learning styles. Kolb states that learning involves the acquisition of abstract concepts that can be applied flexibly in a range of situations.¹⁶

Kolb's stages of learning are as follows:

1. Concrete Experience – reinterpretation of an existing experience or encountering a completely new experience.
2. Reflective Observation – thinking about the new experience and trying to understand inconsistencies between the experience and previous knowledge

3. Abstract Conceptualization - Reflection leads to a new idea or change of perception of a previous abstract concept.

4. Active Experimentation - application of the new idea and observation of outcome.

Based on the above theory, Kolb classified learners into four categories:

1. Divergers – who have a new experience and reflect on it [feel and watch],

2. Assimilators – who reflect and arrive at a concept [watch and think],

3. Convergors – who would like to put to use the new concept [think and do] and

4. Accommodators – who learn from the outcome and are ready to learn from further experiences [do and feel].

A medical graduate often goes through all stages of learning though studies say that there are inherent preferences for specific styles. Further a medical student can begin as learner from any point in the Kolb's cycle and progress forward.

An interesting study was done using the Kolb learning style inventory among students, residents and faculty of surgery.³⁵ It showed that about 50% of the faculty and residents were convergers while assimilators formed the largest group among students. This shows the "think and watch" learning style of students while faculty are in the "think and do" area. But convergers and accommodators were the highest when the overall group was studied. Therefore students as well as faculty prefer to learn by doing or performing whether they "think or watch".

Another interesting observation is insignificant number of "divergers" or those who reflect from concrete experience. This vital area in medical education therefore needs to be strengthened. This study again reiterates Kolb's observation that students change from one style to the next as they progress in studies and go through the cycle repeatedly. This study done among surgery residents has shown majority of the learners as convergers. A similar study with internal medicine residents showed a significant "assimilator" or the "think and watch" learning style. These findings correlate well with varying curricular needs of the specialties.³⁶

Similar to Kolb, Honey and Mumford proposed a classification of learning styles, classifying learners

into activists, reflectors, theorists, and pragmatists.³⁷ A study using the Honey and Mumford classification was done among Pakistani medical students.³⁸ While the postgraduates commonly have the reflector learning style, it is much less amongst the undergraduates. The latter are predominantly activists and theorists. The most desirable learning style for medical professionals i.e. pragmatists and reflectors are the ones least common amongst the undergraduate learners.

4. Principles of learning

Knowles proposed andragogy or the principles of adult learning. Andragogy assumes that adults 1] are self directing and independent 2] have various degrees of prior knowledge or experience 3] integrate learning to the demands of real life experiences 4] consider learning as answers to problems and 5] are intrinsically motivated rather than external drives.³⁹ Application of adult learning principles in teaching methods will therefore include derivation of concepts over stating facts, providing timely activities for application of concepts, facilitating students to formulate their own learning objectives and encouraging evaluation of student performance through their own feedback. Hence these specific adult learning behaviors are also likely to have influences on individual learning styles.⁴⁰

A medical college entrant has to shift from a pedagogic to an androgogic mode of learning⁴¹. But this shift has to be gradual and a teacher has to decide on the levels of guidance required based on the demands of the curriculum. As per Anthony Grasha's teaching style model, a teacher touches four different styles in teaching with increasing levels of androgogy from pedagogy.⁴² These styles are the expert, personal model, facilitator and delegator. A medical student comes from a teacher centric environment and has to slowly get accustomed to student centric methods which mainly involve principles of adult learning. Therefore a medical teacher is faced with the challenge of identifying areas where he has to exhibit his expertise or can allow the student to work independently. Even in a single teaching encounter such as a large group teaching an instructor can employ all teaching styles and can move randomly among various styles to synchronous with the emerging learning needs.

Conclusion

To conclude learning style refers to varying methods by which a learner prefers to take in and process information. The learning style depends on various factors depending on the personality and predominant perception modes of the learner. There are multiple models and theories to determine learning styles. Studies indicate that learning styles vary between medical undergraduates and postgraduates and also within different phases of undergraduate study. Awareness about the various concepts on learning styles can help instructors develop teaching learning methods which are inclusive for all learning styles. Such curricular changes are likely to enhance the effectiveness of teaching programs.

Acknowledgment: Nil

Conflicts of interest: Nil

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