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RESEARCH ARTICLE

Preferred learning styles of medical students in an Indian medical school: Implications for learner-centered pedagogy in competency-based medical education

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ABSTRACT

Background: One of the crucial elements in any medical science teaching–learning is identification of students' learning styles to meet the learner needs. This knowledge can help in reinforcing learning and foster self-directed learning. On the other hand, this information can be utilized by medical teachers to incorporate various instructional modes so as to enhance the learning process and outcomes of students within the given curriculum. **Aim and Objective:** Identification of learning styles in 2nd-year medical students. **Materials and Methods:** This was a cross-sectional survey to assess learning styles utilized by medical students using visual-aural-read/write-kinesthetic (VARK) inventory 7.1. Descriptive analysis was performed to determine the percentage of students in each category. **Results:** About 75% of students participated in the study, with age ranging between 18 and 22 years and a gender predominance of 51% females. VARK analysis showed 64.0% multi-modal (VARK) learners consisting of 38.7% quadri-modal, 17.3% bimodal, and 8% trimodal. In the bimodal category, 9.3% preferred auditory and reading component, 4% favored reading and kinesthetic, and 2.7% preferred visual and auditory component while only 1.3% chose visual and reading component. In the tri-modal category, 5.3% favored visual, auditory, and reading style while 1.3% chose auditory, reading, and kinesthetic components, and the remaining 1.3% opted for visual, reading, and kinesthetic style of learning. The highest unimodal learning modality was auditory 25.3%, then Read/Write 9.3%, followed by kinesthetic and visual (both 2.7%). **Conclusions:** Considering that most of the participants were multimodal learners, designing educational activities that cater to various learning styles can support the learning process. In addition, in long-term it will encourage competency-based medical education.

KEY WORDS: Learning Styles; Medical Education; Learner-centered Pedagogy

INTRODUCTION

Students are the center of any educational organization. Traditional curricula that use "the lecture-and-test" mode of education are being gradually replaced by curricula that use a blend of teaching and learning strategies. At present, medical schools all over the world are prioritizing competency-based medical education (CBME) in their curriculum.[1,2] Initiatives such as these focus on learner-centered pedagogy that helps students in attaining observable abilities in a time-independent manner.[3] Medical teachers can integrate a multitude of teaching methods to enhance learning among students.[4] In light of this, literature reports several definitions of learning style, some of them are as follows: "Learning style is defined psychologically as the way students concentrate, and their

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method in processing and obtaining information, knowledge, or experience."[5] Neil Fleming, the discoverer of VARK, refers to "Learning Styles is an individual's preferred ways of gathering, organizing, and thinking about information."[6]

VARK learning styles questionnaire was introduced by Mills and Fleming in year 2014. VARK is an acronym of four learning styles: Visual (V), auditory(A), read-write (R/W), and kinesthetic (K).[7] Learners who use two or more of learning preferences equitably fall under multimodal learner group.[8] Accustoming oneself with students learning styles at different levels and in different fields of study plays a substantial role in educational settings.

Definitions suggest that students might have different learning styles in the form of unimodal or multimodal patterns. In general, recognizing students learning styles can foster the learning process by designing pedagogical instructional tools which can strengthen areas of predominant learning styles and at the same time support areas of weakness in each style.[9] In light of this, teachers can design a lot of active learning strategies for multimodal learners.[10] A multipronged approach is necessary to keep the attention and motivation of students intact, for example, supplementing study material with active learning modules such as problem-based learning, small group discussions, quizzes, animations, role plays, etc.[11]

The purpose of this study is to identify learning styles among 2nd-year medical students and discuss the usefulness of the findings in the improvement of the learning process.

MATERIALS AND METHODS

A cross-sectional observational study was conducted on Second MBBS students studying at one of the private medical colleges in western India. The study was conducted after obtaining permission from the Institutional Ethics Committee (HREC No. HMPCME:HREC/2015/Out. No.163/15) and written informed consent from participants. The tool used was the visual-aural-read/write-kinesthetic (VARK) learning style inventory 7.1.[12]

What is VARK?

Out of many models on learning styles, the VARK model has been extensively used to study the learning styles of medical students.[13] VARK stands for an acronym for four major sensory modes of learning which are: Visual "V," aural "A," Reading/writing "R/W," and Kinesthetic "K," depending on the neural system with which a learner prefers to receive information. Visual learners learn by looking at pictures, graphs, videos, text, and graphics in multimedia elements, charts, algorithms, concept maps, posters, mnemonics, visual analogies, annotations, and computer-based teaching modules, auditory learners receive learning by podcasts, discussion, reading loudly, story-telling, audiobooks, audio application in multimedia elements, Readers/writers prefer words, and texts as an information obtaining method while Kinesthetic learners are more likely to experience physical movement aspects while studying such as touch, feel, and hold and perform. They prefer hands-on work, practical, simulations, case vignettes, case-based studies, early clinical exposure, role-playing, dissection, community visits, and project-based learning.

VARK version 7.1 questionnaire consists of 14 Multiple Choice Questions with four possibilities to select an answer. Students could select one or more choices for each question. The validity and reliability of the VARK questionnaire are well established.[8,13]

Refer to Appendix 1 for VARK 7.1 inventory.[12]

Before data collection, participants were briefed regarding VARK as mentioned above. Simultaneously, they were also sensitized regarding the aims and objectives of the study. The questionnaire was then distributed in the form of hard copies to those who consented. First, they were asked to fill in their particulars in context to age, gender, and the board of education. Following this, the VARK Inventory tool version 7.1 was administered to students for determining their most preferred learning style. The total time allotted for completing the questionnaire was 1 hour. In regard to VARK, students were distributed into one of the following categories: Unimodal meaning students possessing only one predominant style of learning; Multimodal meaning students exhibiting more than one preference. Multimodal has been further segregated into bimodal-Having two preferences; tri-modal-having three preferences; and quadri-modal-having 4 preferences. Scores were given accordingly. The data were entered into a Microsoft Excel sheet. Descriptive statistics were used to analyze and understand the students' preferences of the various learning styles using STATA14 software.

RESULTS

Section 1: Demographic Profile

Seventy-five out of 100 students participated in the study. The remaining were not present on the day of study. About half of the sample comprised females (51 %). The age of participants ranged between 18 and 22 years (the majority were of 19 years). The majority (88%) of the students completed their schooling from the regional board of education while 5.3% were from Central Board of Secondary Education and the remaining 6.6% were from Indian Certificate of Secondary Education and International board.

Section 2: Assessment of learning style using VARK

Analysis of VARK showed that most of the students were multi-modal (VARK) learners, i.e., 64%. Out of this, Quadri-modal

learners were (38.7%), and Bimodal consisted of (17.3%) while Tri-modal comprised (8%). Out of the 17.3% participants in the bimodal category, 9.3% participants preferred both auditory and reading component (AR), 4% participants favored reading and kinesthetic (RK), and 2.7% participants preferred visual and auditory component (VA) while only 1.3% chose visual and reading component (VR). Out of the 8% participants in the tri-modal category, 5.3% participants favored visual, auditory, and reading (VAR) style while 1.3% participants chose auditory, reading, and kinesthetic (ARK) components and the remaining 1.3% participants opted for visual, reading, and kinesthetic (VRK) style of learning. The highest learning modality was Auditory (25.3%), then Read/Write (9.3%), followed by Kinesthetic and Visual (both 2.7%). Thus, the order of learning style as depicted by results for the given batch was: A> R/W> K = V [Figure 1].

DISCUSSION

Since the most prevalent method of teaching is lectures, teachers need to be making them effective by incorporating various student-centric activities in the curriculum; the same has been reiterated in CBME.[2] Numerous studies support the age-old saying that in "any set up one size does not fit all" meaning thereby that a single teaching method does not fit for every student or even for majority.[14-17] Our study shows that students favored multiple modalities of information presentation as in 64.0% of students favored multiple learning styles.

The results of our study were similar to many other studies conducted in different parts of the world. A study conducted by Ojenh *et al*. reported that a large proportion of medical students used multiple learning system.[18] Literature reports that cognitive researcher's states that multimodal learning is beneficial to anyone as it encourages flexibility in views and acceptance of content modality.[19] It is like preparing our future to be health-care professionals to be more competent for multitasking in various clinical situations. A study conducted by Pritishkumar and Michael, states that (86.8%) students were multimodal.[8] In addition, they emphasize the shift of conventional lecture taking methods to more interactive, student-centric multimodal approaches. Two studies conducted

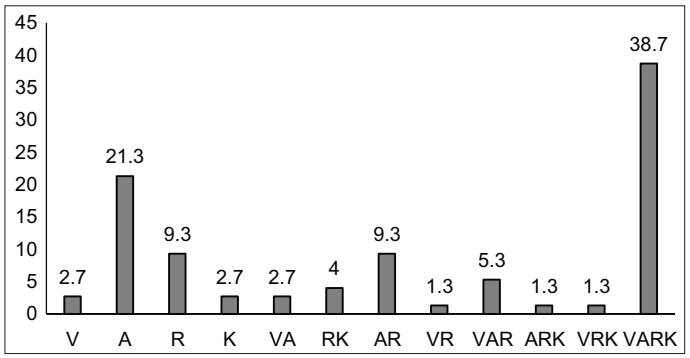

Figure 1: Percentage of participants in various visual-aural-read/write-kinesthetic categories

at different medical schools in India are in agreement with similar findings, i.e., a large chunk, i.e., 61% of the students preferred multiple learning styles.[15,17] Among them, 41%, 14%, and 6% of students preferred bimodal, tri-modal, and the quadri-modal ways of information presentation, respectively. Only 39% of the respondents had a single learning preference. The most common unimodal preference was kinesthetic, followed by visual, auditory, and read and write. The same study states that educators' awareness of learning styles may help in designing several student-centric activities for the students.[17] Similarly, about 63.9% of multimodality and 36.1% unimodality preference among medical students were reported in Baykan and Nacar's study in Turkey,[20] while a study conducted by Lujan and DiCarlo also reveals that 64% of students were multimodal learners.[21] In our study, the majority of the bimodal students showed to had a combination of AR (9.3), followed by RK (4.0), VA (2.7), and VR (1.3). In Lujan and DiCarlo's study, there was a tie between AR and RK, i.e., (6.6) followed by VK, VR, and VA,[21] whereas in Nuzhat *et al*. they had majority showing AK (12.3), followed by VK (10.4), VA (4.7), RK and AR (both 2.8) and VR (1.9).[14] In our study, the majority of tri-modal learners preferred VAR (5.3), followed by ARK and VRK both at 1.3. Whereas in Lujan and DiCarlo,[21] the majority were seen to be dominating ARK (12.3), followed by VRK (11.3) and VAK (8.4). Nuzhat *et al*.'s study showed the majority of learners opting for a tri-modal combination of VAK (17.9), followed by ARK (12.3), VAR (6.6), and VRK (5.7).[14] Evidence implies that students with multimodal patterns as having a balanced set of learning preferences and being able to process information in any variety of learning styles.[22] Thus, multimodal students can adjust themselves to different teaching styles or link a specific learning style to ensure their learning.[9,10,23,24] Regarding predominant learning style, our study reported: Auditory (25.3%) as predominant, then Read/Write (9.3%), and lastly kinesthetic and visual (both 2.7%) in some learners. This was comparable with that of Nuzhat *et al*. which reports preference of auditory learning style by a majority of the students followed by kinesthetic, visual, and read/write learning style.[14] However, Ojenh *et al*. found read/write to be a predominant modality,[18] whereas Kharb *et al*. reported that students mostly favored kinesthetic style of learning, followed by visual, auditory, and the read/write.[17] In Lujan and DiCarlo's study, students gave preference to kinesthetic style (18.1%), followed by read/write (7.8%), visual (5.4%), and aural (4.8%).[21] A study conducted by Pritishkumar and Michael in a South Indian medical school also reports the auditory to be the highest learning preference in unimodal learners.[8]

Strength and Limitations

Thus, to successfully improve their clinical knowledge and skills, medical students need to follow more than one style of learning; this will be invaluable when faced with challenges as future doctors. Hence, finally what is the use of identifying learning styles? One of the potential uses is need to make

them learner aware of their preferred learning style so that they can make a deliberate effort to learn through other styles as well and second for teachers the message is that they can try to provide a buffet from where not only each can pick what he wants but also try some new food.[25] One of the apparent uses of learning style inventories could be to develop personalized courses, or use it in remedial education. Thus, identification of students' learning styles can augment the teaching-learning process, improve experiential learning, and boost competency development among students. At the same time, it can be a challenging task for medical educators to incorporate learner-centered teaching strategies into didactic courses that are traditionally heavy in content versus smaller experiential courses such as practical's and internships.[26,27]

CONCLUSIONS

This study affirms the heterogeneity in students' learning preferences. Besides this, it suggests the need for instructors in health disciplines to consider blending appropriate and numerous teaching learning modules to maximize students learning. The authors of this paper hope that by taking such initiatives medical educators can make the learning process more learners centric and interactive, as recommended under CBME.

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APPENDIX

APPENDIX 1

The VARK questionnaire (Version 7.1)

1. You are helping someone who wants to go to your airport, the center of town or railway station. You would:
   A. Go with her.
   B. Tell her the directions.
   C. Write down the directions
   D. Draw or give her a map.
2. You are about to purchase a digital camera or a mobile phone. Other than price, what would most influence your decision?
   A. Trying or testing it.
   B. Reading the details about its features
   C. It is a modern design and looks good.
   D. The salesperson told me about its features
3. You have to make an important speech at a conference or special occasion. You would:
   A. Make diagrams or get graphs to help explain things.
   B. Write a few keywords and practice saying your speech over and over.
   C. Write out your speech and learn from reading it over several times.
   D. Gathers many examples and stories to make the talk real and practical.
4. I like websites that have:
   A. Things I can click on, shift, or try.
   B. Interesting design and visual features.
   C. Interesting written descriptions, lists, and explanations.
   D. Audio channels where I can hear music, radio programs, or interviews.
5. Other than price, what would most influence your decision to buy a new non-fiction book?
   A. Describe some of the highlights.
   B. Use a map or website to show them the places.
   C. Give them a copy of the printed itinerary.
   D. Phone, text, or email them.
6. You are going to cook something as a special treat for your family. You would:
   A. Cook something you know without the need for instructions.
   B. Ask friends for suggestions.
   C. Look through the cookbook for ideas from the pictures.
   D. Use a cookbook where you know there is a good recipe.
7. You have a problem with your heart. You would prefer that the doctor:
   A. Gave you something to read to explain what was wrong.
   B. Used a plastic model to show what was wrong.
   C. Described what was wrong.
   D. Showed you a diagram of what was wrong.
8. You want to learn a new program, skill, or game on a computer. You would:
   A. Read the written instructions that came with the program.
   B. Talk with people who know about the program.
   C. Use the controls or keyboard.
   D. Follow the diagrams in the book that came with it.
9. You are planning a vacation for a group. You want some feedback from them about the plan. You would:
   A. Describe some of the highlights.
   B. Use a map or website to show them the places.
   C. Give them a copy of the printed itinerary.
   D. Phone, text, or email them.

10. Do you prefer a teacher or a presenter who uses:
    A. Demonstrations, models, or practical sessions.
    B. Question and answer, talk, group discussion, or guest speakers.
    C. Handouts, books, or readings.
    D. Diagrams, charts, or graphs.
11. Remember a time when you learned how to do something new. Try to avoid choosing a physical skill, for example, riding a bike. You learned best by:
    A. Watching a demonstration.
    B. Listening to somebody explaining it and asking questions.
    C. Diagrams and charts – visual clues.
    D. Written instructions – for example, a manual or textbook.
12. A group of tourists wants to learn about the parks or wildlife reserves in your area. You would:
    A. Talk about or arrange a talk for them about parks or wildlife reserves.
    B. Show them internet pictures, photographs, or picture books.
    C. Take them to a park or wildlife reserve and walk with them.
    D. Give them a book or pamphlets about the parks or wildlife reserves.
13. You are about to purchase a digital camera or a mobile phone. Other than price, what would most influence your decision?
    A. Trying or testing it.
    B. Reading the details about its features.
    C. It is a modern design and looks good.
    D. The salesperson telling me about its features.
14. You are going to choose food at a restaurant or cafe. You would:
    A. Choose something that you have had there before.
    B. Listen to the waiter or ask friends to recommend choices.
    C. Chooses from the descriptions on the menu.
    D. Look at what others are eating or look at pictures of each dish.