



ORIGINAL ARTICLE

Learning styles of medical students.

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ABSTRACT... Objective: To assess the various learning styles of fourth year medical students using VARK inventory. **Study Design:** Descriptive Cross-sectional study. **Setting:** Department of Community Medicine, Lahore Medical & Dental College, Lahore. **Period:** May to July, 2022. **Material & Methods:** Study was commenced after obtaining permission from 2022 VARK Learn Limited to use the VARK inventory and after review by IRB, LMDC. Study tool used was questionnaire with the VARK inventory version 7.8. The VARK inventory is a pre-tested and validated tool developed to assess learning styles of students on basis of visual, aural, read/write and kinesthetic styles. Data entry and analysis was done using IBM SPSS software version 21. Students were grouped according to learning styles as well according to number of preferred styles (uni-modal and multi-modal). Comparison of student gender and pre-medical qualification against learning style were performed using chi-square test. **Results:** Amongst the participants 52.1 % were female while 84% of students had completed their FSc before admission to MBBS. It was seen that that most commonly favored learning style was Kinesthetic mode (n=133) followed by auditory (n=131), then 108 visual learners and only 88 read-write learners. Results showed that only 2 participants were uni-modal learners while the remaining 98.6% of students were multi-modal learners. Amongst the multimodal learners, 40% were quadra-modal learners, 40% tri-modal learners and 19% bi-modal learners. **Conclusion:** In conclusion, multimodal learning approaches are the most preferred learning modality. This implies that both teachers as well as students should incorporate multiple learning styles in their teaching as well as learning process.

Key words: Learning Styles, Medical Students, VARK Inventory.

INTRODUCTION

For years students have been taught via conventional means such as classroom lectures however in modern day teaching, educators have a tendency to incorporate audio-visual aids in teaching. In the same manner, as teaching methodologies vary over the years, students have also adopted various strategies to attain knowledge. Each student has a different perception based on their personal preferences or individual sensory abilities to the imparted knowledge. Learning style is used to describe how information is gathered, processed, interpreted, organized and thought of by students. Dr Malcolm Knowles' pointed out that adult learning should be based on the principle of "learner-centered" or self direction, in which active participation has to be taken up by the learner. One way of inculcating

active participation of students is by providing tools such as a learning inventory.^{1,2}

In 1987, the VARK model was developed by the educationist Neil Fleming. In this model he pointed out four learning modalities which are visual, auditory, read/write and kinesthetic and based on them the VARK inventory was developed by him.²⁻⁴ He believed helping students identify their learning styles could help them modify their learning strategies and hence improve their learning experiences. Use of learning strategies according to student preferred modality would lead to better comprehension, increased motivation, and persistence in learning.²

Medical teaching requires both clinical as well as theoretical knowledge. Optimum teaching should

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be such that addresses all learning modalities. This can be achieved by utilization of different teaching methodologies and styles which would cater to a variety of student needs and thereby allow students to excel.⁵

Students who prefer visual mode of learning are keen on observations. They rely on diagrams, graphs and figures to visually grasp concepts. Aural learners are those who rely on their auditory sense to learn. This includes listening to recordings, lectures, podcasts and discussion amongst peers or with teachers, questioning as well as recalling. Next, read/write learners are those who use printed text as the most important way to convey and receive information. They use books, notes, handouts either on screens or on paper. Lastly, kinesthetic learners prefer experiencing or doing things themselves. This modality explores physical experiences involving taking part in an activity, practical problem solving, touching or moving objects.^{2,4,6}

Students, though capable of using all these learning modalities, are inclined to develop personal preference of any one or more of the learning methods. Students that show a significant preference of any one mode are known as uni-modal learners. Students who prefer any two learning modalities are known as bi-modal learners, those inclined to three modes are tri-modal, while learners who are engaged in all forms of learning modalities are quadra-modal learners. Collectively, bi, tri and quadra-modal learners are known as multi-modal learners.⁶

Learning styles may be influenced by many student factors such as age, sex, sensory disability and pre-medical education and any other personal preference. Pre-medical qualification, in the context of Pakistan, is mainly of two types: Intermediate school certificate carried out by Board of Intermediate Education; while Advanced Levels are carried out by Cambridge University International assessment. These two education systems vary considerably in their teaching and learning methodology and examination systems. We believe that students hailing from these two different educational backgrounds may

have significant influence on their preference of different learning modalities.

In this research, we aim to make medical students aware of their preferred learning styles so that they may be able to modify their learning strategies and in return achieve academic success.

MATERIAL & METHODS

A cross sectional survey was carried out at Lahore Medical and Dental College, Lahore between May to July 2022. The study population was fourth year MBBS students of LMDC. A total of 144 students took part in the study out of 174 regular students, with a response rate of 82.8%. Study was commenced after obtaining permission from 2022 VARK Learn Limited to use the VARK inventory and after review by Institutional review board of LMDC (8365-66). Non-probability convenience sampling technique was used and data collection was done after informed verbal consent.

A questionnaire was used as the data collection tool using the VARK inventory version 7.8. The VARK inventory is a pre-tested and validated tool developed to assess learning styles of students on basis of visual, aural, read/write and kinesthetic styles. VARK inventory is made up of 16 questions and students may choose one or more answer for each question or skip a question altogether.

Data was first analyzed manually on the questionnaires by allocating the answer of each answer to its corresponding learning style (VARK) using the VARK grading scale and then summed up. Data entry and analysis was done using IBM SPSS software version 21. Students were grouped according to learning styles as well according to number of preferred styles (uni-modal and multi-modal). Comparison of student gender and pre-medical qualification against learning style were performed using chi-square test.

RESULTS

Amongst the participants 52.1 % were female while 84% of students had completed their FSc before admission to MBBS. Analyzing the results, it was seen that the most commonly favored

learning style, in different combinations, was Kinesthetic mode (n=133) followed by auditory learners (n=131) as depicted in Table-I, showing average scores of each student.

Learning Modality	Mean Score	Standard Deviation	Total Frequency
Visual	4.68	2.367	105
Auditory	6.08	2.255	131
Read/ Write	4.00	2.055	88
Kinesthetic	6.31	2.546	133

Table-I. Average score and SD of each individual learning modality

Results showed that only 2 participants were uni-modal learners while the remaining 98.6% of students were multi-modal learners as shown below in Figure-1 and Table-II.

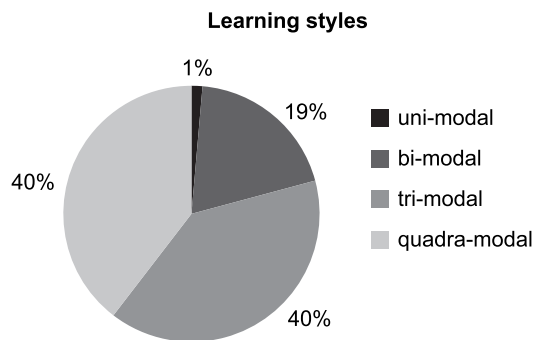


Figure-1. Frequency of learning style modalities

	Frequency (n) (%)
Uni-modal (n=2)	
A only	1 (0.7%)
V only	1 (0.7%)
Bi-modal (n=28)	
A, K	18 (12.5%)
A, R	3 (2.1%)
V, A	2 (1.4%)
R, K	1 (0.7%)
V, K	4 (2.8%)
Tri-modal (n=57)	
V, R, K	7 (4.9%)
V, A, K	30 (20.8%)
V, A, R	4 (2.8%)
A, R, K	16 (11.1%)
Quadra-modal (n=57)	
V, A, R, K	57 (39.6%)

Table-II. Frequency of preferred learning modalities* (N=144)

* A: Audio, K: Kinesthetic, R: Read/Write, V: Visual

The different learning modalities when compared individually showed a significant difference between A-level and FSc qualified students for kinesthetic learners, while no significance was seen between male and female medical students in their individual learning styles combinations. Results are depicted in Table-III and Table-IV.

Learning Style	Pre-entry Qualification		Total	P-Value
	FSC	A Levels		
Visual	87	18	105	0.529
Auditory	112	19	131	0.127
Read/Write	72	16	88	0.364
Kinesthetic	115	18	133	0.005

Table-III. Effect of pre-entry qualification on learning style

Learning Style	Gender		Total	P-Value
	Male	Female		
Visual	53	52	105	0.313
Auditory	62	69	131	0.654
Read/Write	39	49	88	0.279
Kinesthetic	64	69	133	0.865

Table-IV. Effect of gender on learning style

DISCUSSION

Medicine to date remains an ever transitional, evolving domain with new advancements in medications and treatment regimes. Hence, in order to keep abreast with the medical curriculum as well as latest advancements, medical education requires continuous and persistent effort in learning. Formerly, education was mostly attained by reading and writing of textbooks. Over the years, teaching and learning methods in medicine as well as education in general have turned away from orthodox styles and have now incorporated new methodologies to aid students. As mentioned earlier, Fleming introduced the world to newer learning styles such as visual, auditory and kinesthetic learning.^{1,2} Worldwide the VARK questionnaire has been used by both educators and learners to aid their teaching and learning processes. The online version of the VARK questionnaire version 8.01 was filled by 237,537 respondents on the VARK learn limited webpage between May to August 2020 globally. Amongst these the single most preferred sensory modality was kinesthetic, found in 22.8% of the participants. Results also showed that 66% of

respondents had multimodal learning preferences of which quadra-modal sensory modality was seen in 30.6% of the respondents.⁷

Our study reiterated results from previous literature depicting that students were now more inclined to turn to visual, auditory and kinesthetic learning as opposed to traditional learning via reading and writing. A recent study from Islamabad, Pakistan showed that the most preferred learning style amongst medical students was kinesthetic learning found in 34% of students followed by auditory learning in 29%, then 20% visual learners and only 17% of read/ write learners.⁸ Similarly, in our study we also saw that most preferred learning style was kinesthetic learning followed very closely by auditory learning, then visual and lastly read/ write learning. Another local study also reported that collectively kinesthetic mode of learning was the most popular amongst medical students. However, in this case kinesthetic learners were followed by read/write learners, then aural and lastly visual learners.⁶ Likewise, a study from India also showed that kinesthetic learning was the most popular learning style amongst medical students, then auditory, then visual and finally read-write learners.⁹ Yet another study from India also showed analogous results.¹⁰ On the contrary, a study carried out in Barbados in 2017 found read/write learning to be the most prevalent learning modality. This was closely followed by kinesthetic learners as the second most preferred sensory modality while visual learning was considered least popular.¹¹

We also saw that as pointed out in previous literature, students favor using more than one sensory modality making them multi-modal learners. Corresponding to our study results, a local study showed that 99.6% learners were multimodal⁸ while we found 98.6% learners to be multimodal. However, in this study quadra-modal learners were predominantly high (95.6%) of the multimodal learners as opposed to our study where we found comparable frequency between quadra-modal and tri-modal learners. On the contrary, two international studies from India and Turkey showed much higher prevalence of uni-modal learners being 39.0%

and 36.1%, respectively, however even they showed that majority of students remained multi-modal learners.^{1,2,12} Another study from Chile also highlighted that 68.9% of students were multimodal learners, while the single most commonly used sensory modality was kinesthetic learning.¹³ Likewise, a study from California also showed similar results.¹⁴ Another study from Uttar Pradesh India found that 61% of first year medical students were multimodal of which majority were bimodal learners (41%). Amongst the uni-modal learners, kinesthetic learning was again the most preferred learning modality.¹⁵

This multimodal preference signifies the need for incorporation of different teaching methodologies beyond conventional lectures, which only cater to auditory learners. In order to cater to the diverse learning styles of students, educators must rely on various mediums such as auditory lectures, lecture handouts, additional reading material, videos, graphs, images, hands-on demonstrations, interactive elements and others. Furthermore, since the single most preferred sensory learning modality was kinesthetic learning, teaching methods must include active participation of students in the form of hands-on training sessions. In fact active learning sessions can be beneficial to all students, even those with other preferred sensory modalities.

One limitation of this study was the limited sample size. A larger sample size would have better demonstrated relationship between demographic variables and learning styles. Another limitation was inability to assess student academic achievement and its relationship with preferred learning style. We recommend repeating the study in a multi-centre approach with much larger sample size along with incorporating students' results in the study so that a relationship between preferred learning styles and academic achievements can be established.

CONCLUSION

In conclusion, multimodal learning approaches are the most preferred learning modality. This implies that both teachers as well as students should incorporate multiple learning styles in



their teaching as well as learning process.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Asiya Karim	Data collection and data entry.	
3	Amina Laraib	Data collection and data entry.	