ORIGINAL ARTICLE

Exploring the Preferred Learning Styles among Undergraduate Medical Students and Postgraduate Residents by Using VARK Inventory

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ABSTRACT

Background: Factors that influence learning are educators, students, curriculum, and educational environment. In order to improve the learning environment, educators should know about different learning styles adopted by students, so that they can efficiently design the teaching strategies and methodologies to cater to the learning needs of students.

Aim: To determine various learning styles of undergraduate medical students and postgraduate residents by using VARK questionnaire; to determine the comparison between undergraduates and postgraduates' learning styles.

Methods: A cross-sectional study was conducted to collect data about the learning style preferences of undergraduate medical students and postgraduate residents of Fatima Jinnah Medical University, Lahore and Sir Ganga Ram Hospital, Lahore. The VARK questionnaire was used to categorize the learning styles as Visual (V), Auditory (A), Read and Write (R) and Kinesthetic (K). This study was conducted from 15 July to 15 August 2019. A total of 208 students were selected randomly from final year MBBS and postgraduate residents of Sir Ganga Ram Hospital, Lahore.

Results: Among 208 students, 102 were undergraduate students, and 106 were postgraduate residents. The most common learning style was Kinesthetic (34%), followed by Auditory (29%), Visual (20%), and Read/Write (17%). The unimodal and multimodal percentages of students were 62% and 38%, respectively. Results had shown that maximum (34%) students of both categories learn a new thing by using Kinesthetic learning style, whereas minimum (17%) were inclined towards Read/Write learning style. Same distribution pattern prevailed in both categories independently i.e., 36% undergraduate students and 32% postgraduate residents preferred Kinesthetic learning style while 15% and 19% of same liked Read/write learning style respectively.

Conclusion: The majority of undergraduate students and postgraduate residents in this study had a unimodal learning style. The most common learning style of all students was Kinesthetic (K), which was followed by Auditory (A), Visual (V), and Read/Write (R).

Keywords: Learning styles, VARK, Postgraduate residents.

Introduction: Learning is a continuous process influenced by factors like educators, students, course/curriculum, and educational environment (Hutchinson, 2003). In past few years, there has been a switch from conventional passive learning approach to more innovative active learning approach (Choules, 2007). Educators should be aware of different learning styles of students, so that they can devise appropriate educational strategies and methods to fulfil the learning needs of their students. Medical students are expected to comprehend, absorb, remember and apply an immense amount of information imparted to them throughout their learning and training years (Tolsgaard, 2013), therefore, their preferred learning styles should be known to educators.

There are different models to assess learning styles. The VARK model is one such example. The V of VARK stands for Visual, A for Aural, R for Read/Write, and K for Kinesthetic. Fleming designed the VARK tool as a validated questionnaire (Fleming, 2011), which is useful in recognizing the student's preferred learning mode (Leit et al., 2010). Initially, it was used to determine the learning styles of undergraduate students, but later on, it was also used to assess the learning styles of postgraduates. Visual and auditory learners learn by seeing and hearing while read/write learners prefer printed material. Whereas, kinesthetic learners learn through physical and practical experience.

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As per the study conducted by Nilemcho Ojeh and colleagues in 2017, a large number of students were found to be multimodal learners. The most common learning style was Read/Write (38.8%), followed by Kinesthetic. This study assisted educators in devising blended teaching methodologies to fulfil the learning needs of students (Ojeh et al., 2017). Laista Samarakoon and colleagues conducted another study in 2013 for the assessment of learning styles among the undergraduate and post-graduate students by using the VARK questionnaire. According to this study, undergraduate students (67.5%) were multimodal but a large number of postgraduates (52.9%) were unimodal learners (Samarakoon et al., 2013).

Imparting of vast amount of knowledge in a defined time period, which is to be retained, remembered, and effectively interpreted by a student, is a challenge for an educator. The VARK model can help educators in devising appropriate teaching and assessment methodologies. If learners are Kinesthetic, more practical sessions like bedside and case-based teaching methods should be adopted. For Visual learners, lectures could be made more interesting through pictorial presentations, videos, and graphic material. The teaching sessions for learners with Auditory preferences should be made more interactive with small group discussions and relevant audio-visual material. If the preferred learning style is Read/Write, handouts, and printed reading material to be provided to the learners (Romanelli et al., 2009).

At present, there is little literature available nationally and locally to determine various learning styles of students, both undergraduates and postgraduates. Our current teaching methodologies are heavily dependent on lectures and self-study but information technology has changed the learning styles of the students. The most suitable way is to be identified to address the needs of teaching and learning instructions to help the students to be more capable learners. However, this particular study will help in identifying the current local trends of learning styles among students. This would further assist the teaching faculty in reviewing and improving their teaching strategies/ methodologies.

Methodology: A cross-sectional study was commissioned on 208 randomly selected students of final year MBBS at Fatima Jinnah Medical University, Lahore (FJMU) and postgraduate residents of Sir Ganga Ram Hospital, Lahore. For this study, the population of students was stratified (grouped) into two homogenous strata (groups) using the stratification factor of Level of the students (Level-1: undergraduates; Level-2: postgraduates). By using the method of Proportional Allocation, a random sample of 208 students was selected, in which 106 students were selected from the stratum of postgraduate residents and 102 from the stratum of undergraduate medical students. The objective of the stratification of the students' population is to cope with the issue of variation in the learning attitude of both levels of students. It creates homogeneity within the stratum i.e., similarity within the same level of the students and heterogeneity between both strata.

The duration of the study was from 15th July to 15th August 2019. Institutional Review Board (IRB) granted approval for the said study. The VARK questionnaire was used to determine the learning styles as Visual (V), Auditory (A), Read/Write (R), and Kinesthetic (K). There were 16 questions in the questionnaire. Each question had four options. The participants in the study had the option to select more than one options for each question. The study included the final year MBBS students of FJMU and postgraduate residents of Sir Ganga Ram Hospital. FJMU is a female University; therefore, all undergraduate participants were female. To rule out bias, all male postgraduate residents and incomplete questionnaires were excluded from the study. After obtaining written informed consent, the VARK Questionnaire was given to final year students in the class room and to postgraduate residents in their wards, respectively, after a detailed briefing about the study and questionnaire. Questionnaires were collected after two days and evaluated by using previously validated scoring instructions available on VARK Website. The data was then analyzed with the help of SPSS.

Results: In this study, 208 students were asked to indicate their learning style**s.** Among 208 students, 102 (49%) were undergraduate final year MBBS student, and 106 (51%) were postgraduate residents. Out of 106 postgraduate residents, 64 (60.4%) were doing FCPS, and 42 (39.6%) MS. The mean age was found as 28.47 ± 2.38 years. According to the year of training of postgraduate residents, most of the respondents were from the 2nd year i.e., 34 (32.1%) of their training. The details of the participants are summarized in Table 1 and Table 2.

Table 1: Age and Educational Status of Students

Educational Status	Frequency	Percentage (%)
Undergraduate Students (Final Year MBBS)	102	49
Postgraduate Residents	106	51
FCPS Residents	64	60.6
MS Residents	42	36.9

Table 2: No. of Residents in Each Year of Residency

Year of Residency	Frequency	Percentage (%)
1st year	28	26.4
2nd year	34	32.1
3rd year	25	23.6
4th year	19	17.9

The objective of the variability analysis is to find the dispersion level of responses of respondents in the sample about a specific topic of investigation. The mean ± standard deviation was analyzed for subscales of VARK according to educational groups that are undergraduate and postgraduate students.

Table 3: Variability Analysis between undergraduates & postgraduates Students

Students Categories	N	Mean	Std. Deviation	C.V(%)
Postgraduate	106	2.2848	0.40321	17.65%
Undergraduate	102	2.2708	0.34135	15.00%

The above table shows that mean and std. deviation for postgraduate students is 2.2848 and 0.40321 (according to the coding scheme: K:1, A:2, R:3, V:4, mean & variation show the general & deviational trend of the category switching from approach K to V) and for undergraduate students, the same are 2.2708 and 0.34135 respectively. The average opinion of the VARK learning style of undergraduate and postgraduate students is almost the same but variation among the postgraduate students is 17.65% as compared to undergraduate students, which is 15%. Therefore, the undergraduate students are more consistent in opinion in the VARK learning style than postgraduate residents.

Each questionnaire comprises 16 different questions regarding VARK attributes of learning by a student. VARK stands for Visual (V), Aural (A), Read / Write (R), Kinesthetic (K). (The Likert scale coding scheme: K:1, A:2, R:3, V:4).

The following Table is a Frequency Table of all students in both categories i.e., undergraduate and postgraduate students regarding the learning attitude towards VARK along with the percentage of each group and in parentheses, a Confidence Interval (CI) at 95% level is given, which shows the least and the most value of the percentages in the population on the basis of a selected random sample.

Table 4: Learning Styles between Undergraduates & Postgraduates Medical Students

	Learning Styles Total Numbers (%) 95% Confidence Interval (CI)			
	Visual	**Auditory**	**Read/Write**	**Kinesthetic**
Undergraduate	20(20%)	30(29%)	15(15%)	37(36%)
	(12.2-27.7)	(20.1-37.8)	(8.0-21.9)	(26.6-45.3)
Postgraduate	21(20%)	31 (29%)	20(19%)	34(32%)
	(12.3-27.6)	(13.3-42.7)	(5.4-30.5)	(17.6-48.3)
Total	**41(20%)**	**61(29%)**	**35(17%)**	**71(34%)**
	(10.1-25.8)	**(20.3-37.6)**	**(9.8-24.1)**	**(24.9-43.0)**

Results given in the above table shows that maximum (34%) students of both categories learn a new thing by using K style of learning, whereas minimum (17%) are inclined towards learning style of R. Same distribution pattern prevails in both categories independently i.e., 36% undergraduate and 32% postgraduate students like learning style of K while minimum 15% and 19% like R style of learning respectively.

A 95% Confidence Interval (CI) shows on the basis of a sample of 71 (34%) students of both categories in the whole population

of medical students, i.e., 24.9% to 43.0% students are inclined towards K learning style and the probability of this statement to be true is 95% with only 5% probability of same to be wrong.

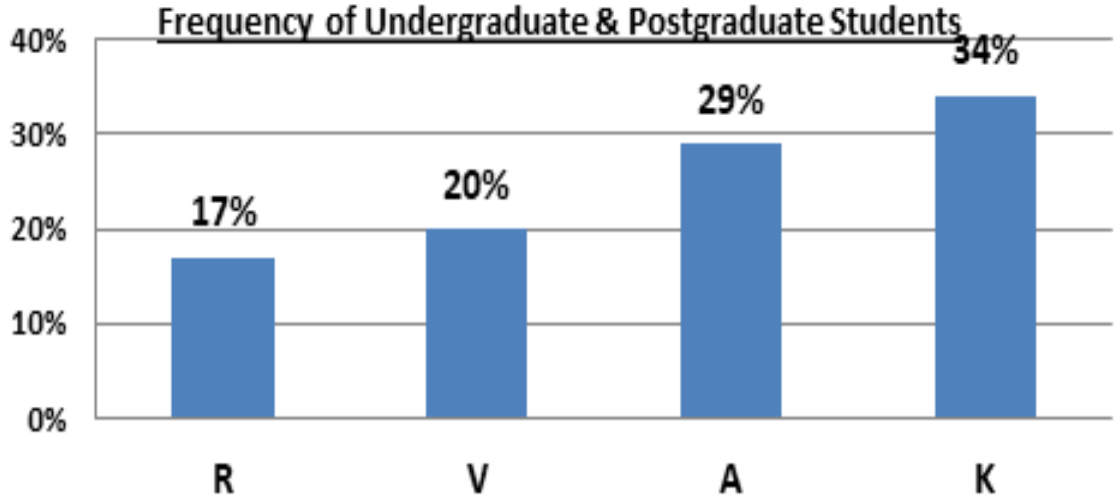

Figure 1: Frequency Bars of VARK of the joint category of students

If we group (R+V) and (A+K) as two groups of learning, then it is evident from Figure No.1 that only 37% of students fall in the first group (R+V), and almost twice of that 63% of students fall in the second group (A+K) i.e., the majority of the students follow the trends of learning styles of A & K.

Table 5: Trends of Learning Styles

	Undergraduate (%)	**Postgraduate (%)**
V	20	20
A	29	29
R	15	19
K	36	32

The frequency trend towards VARK of postgraduate students is the same as in the case of joint category students of both levels i.e., maximum (32%) prefers K and minimum (19%) goes with R styles of learning.

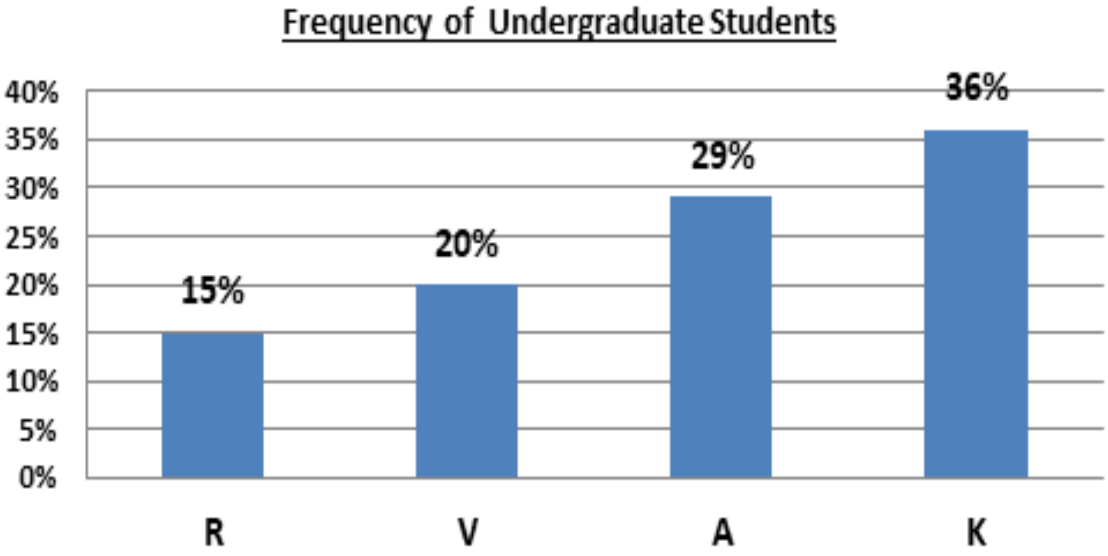

Figure 3: Frequency Bars of VARK of Undergraduate students

The following Frequency Table shows all students in both categories i.e., undergraduates and postgraduates' preferences regarding Unimodal, Bimodal, and Trimodal learning styles towards VARK along with the percentages of each group and in parentheses, a Confidence Interval (CI) at 95% level of confidence is given, which shows the least and the most values of the percentages in the population on the basis of a selected random sample.

Table 6: Mode of Learning Styles between undergraduate & postgraduate Medical Students

	Learning Styles Total Numbers (%) 95% Confidence Interval (CI)			
	Unimodal	**Bimodal**	**Trimodal**	**Total**
Undergraduate	60(59%)	33(32%)	9(9%)	102(49%)
	(49.4-68.5)	(22.9-41.0)	(3.4-14.5)	(42.2-55.7)
Postgraduate	69(65%)	26 (25%)	11(10%)	106(51%)
	(55.9-74.0)	(16.7-33.2)	(4.2-15.7)	(44.2-57.7)
Total	**129(62%)**	**59(28%)**	**20(10%)**	**208(100%)**
	(55.4-68.5)	**(21.8-34.1)**	**(5.9-14.0)**	**(1.0-1.0)**

Results given in the above Table show that maximum (62%) students of both categories learn a new thing by using only one learning style, whereas minimum (10%) have been using three learning styles. The results show that the maximum difference between undergraduate students and postgraduate residents is in the case of bimodal learning i.e., 32% of undergraduates and 25% of postgraduates use a bimodal approach of learning.

There is a certain level of commonality regarding VARK Learning Styles between undergraduate and postgraduate students. To measure the level of association between assessments of both categories/levels of students, a non-parametric approach, Spearman's Coefficient of Rank Correlation is used.

Table 7: Spearman's Coefficient of Rank Correlation

		Postgraduate	**Undergraduate**
Postgraduate	Correlation Coefficient	1.00	0.701
	Sig. (2-tailed)		0.002
Undergraduate	Correlation Coefficient	0.701	1.00
	Sig. (2-tailed)	0.002	

The result of the Coefficient of Rank Correlation between undergraduates and postgraduates is 0.701*. The value of Spearman's Coefficient of Rank Correlation 0.701 (70.1%) can be interpreted as the learning style of students of both categories/levels is 70.1% identical. The value of Coefficient of Rank Correlation 0.701 is marked by an asterisk (*), which shows that the result is significant at a 95% level of confidence. There is an insignificant association between the Learning Styles at undergraduate and postgraduate levels.

Table 8: Chi-Square Tests

Chi-Square Tests			
	Value	Df	Ayump. Sig. (2-sided)
Pearson Chi-Square	12.170[a]	3	**.007**
Likelihood Ratio	12.205	3	.007
Linear-by-Linear Association	.741	1	.389
N of Valid Cases	3328		
a. 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 274.62.			

As the p-value is (0.007 < 0.05) at α=5% level of significance, therefore, Ho is rejected and it is concluded that though the majority of students of both undergraduate and postgraduate levels follow a similar learning style still there are large numbers of students who follow different styles therefore the difference is not by chance and is statistically significant as p-value is less than 5%.

Discussion: In this study, a VARK questionnaire was given to undergraduate and postgraduate students to indicate their learning styles. A large number of participants are unimodal (62%) which indicates that they liked a single mode of learning style. These results are similar to the results of studies conducted in Saudi-Arabia reporting unimodal pattern of learning style (Nuzhat et al., 2011). The results of this study are similar to the work of Almigbal (Almigbal, 2015) and Liew (Liew et al., 2015). The studies by Siddiqi (Siddiqi et al., 2012) and Haq (Haq et al., 2012) also support the domination of unimodal. However, there are also studies using VARK and they came up with results that multimodal is in the majority. Murphy (Murphy et al., 2004) and El Tantawi (El Tantawi et al., 2009) from the USA, and Baykan from Turkey showed domination of multimodal (Baykan et al., 2007).

In the unimodal learning style, it is found that the preferred style was Kinesthetic (34%), followed by Auditory (29%), Visual (20%), and Read/Write (17%). The findings of this study are similar to a study conducted on Indian medical students (Kumar et al., 2011). The study by Lasitha Samarakoon and his colleagues had also shown that postgraduates are unimodal, and their preferred learning style was Kinesthetic (Samarakoon et al., 2013). Kinesthetic style of learning was common among Australian nursing students (D'Amore et al., 2012). In the current study, the commonest learning style observed in undergraduates and postgraduates is Kinesthetic, which is not supported by studies of Rezigalla and colleagues (Rezigalla et al., 2019), as they showed most dominant learning style as Aural (66.6%) followed by Kinesthetic (38.3%). A local study conducted by Abdul Razzaq had shown that the most common learning style was sequential that included visual, auditory, and writing among undergraduates (Razzaq et al., 2018).

In medical institutes, curriculum contents are shifting from recalling of basic knowledge to application, analysis and synthesis of knowledge through critical thinking. Due to this change, the preferred learning style of final year students is Kinesthetic. The shift from multimodal to unimodal shows that students want to learn new things by doing and practice. The active learning strategies such as role-playing, simulators, use of models, hands-on practice for various procedures, live scenarios, and bedside interaction with patients are liked by kinesthetic learners that would be more beneficial for the students than the traditional lectures. Active learning enhances not only critical thinking but also enhances problem-solving and decision-making skills. This study, along with other above-mentioned studies, shows that the students are predominantly shifting from multimodal to unimodal. Their learning styles are also shifting from other styles to Kinesthetic style.

The results of this study cannot be generalized for all medical students as only female students were part of it and no comparison was made between teaching styles/methodologies of faculty with respect to student learning styles. Furthermore, the VARK questionnaire analyzes only one aspect of learning style. More research is required on the subject of learning style preferences and teaching methodologies.

The insight in learning styles is important for both students and educators. In this way, educators can recognize their students preferred learning styles, which can help them in devising appropriate learning methodologies that are required to satisfy the students' learning preferences. As a result, students become independent, self-governed and persistent learners and can enhance their learning outcomes. This would not only create an efficient learning environment, but it would also motivate the students to achieve academic success.

Conclusion: This study addresses the gaps of knowledge about the preferred learning styles of undergraduate students and postgraduate residents in Fatima Jinnah Medical University and Sir Ganga Ram Hospital, Lahore. It gives a better insight into the difference in learning styles among undergraduates and postgraduates. It also provides a baseline study for researchers who are looking for possible changes in learning styles and links to the preferred methods of instructional strategies and assessment tools. The learning style information can also help the students in devising desired learning strategies to enhance their learning outcomes.

Declaration of Interest: The authors report no declaration of interest.

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