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A Study of the Relationship of Learning Styles of Undergraduate Medical Students to Academic Achievements

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ABSTRACT

Objective: To find out whether learning styles influence the academic achievements of students of medical schools.
Study Design: Cross-sectional study.
Place and Duration of Study: Mohtarma Benazir Bhutto Shaheed Medical College, Mirpur, Azad Jammu and Kashmir, Pakistan, from Jun 2018 to Jun 2019.
Methodology: Two hundred medical students participated in the study by completing VARK (visual, aural, read/write, kinaesthetic) questionnaire. The learning styles were assessed based on the questionnaire. The performance grades were obtained from the students' Department of the college.
Results: Most students preferred unimodal learning 104(52%). However, there was a statistically significant gender difference. Most male students preferred unimodal learning (62.7%), whereas female students preferred bimodal (41.4%) learning styles. Aural learning was the most prevalent in the unimodal group 42(21%) in both male and female groups. The academic achievement was labelled as low (<50% marks in annual tests) and high (>50% marks). There were 72.5% (n=145) of high-achievers. More male students were high-achievers than female students (80.5% vs. 68.4%). There was no significant relationship between learning style and academic outcome.
Conclusion: There was no difference in the outcome of academic achievement in subgroups of different learning styles. Further analysis revealed no gender differences in the effect of learning style on academic achievement.

Keyword: Academic achievement, Critical thinking skills, Learning styles, Medical education, VARK (visual, aural, read/write, kinaesthetic).

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INTRODUCTION

Learning style is the combined end-point influence outcome of several factors.[1] These include physiological, emotional, psychological, developmental, cognitive and other environmental factors. The outcome of the performance of an individual usually reflects the ultimate influence of the learning style. Many models and tools for assessing learning styles have been described in the literature. VARK method, practised in the form of a questionnaire, is one of the methods to measure the learning style and assesses Visual (V), Aural (A), Read/Write (R) and Kinaesthetic (K) modalities of learning. VARK method was first developed by Fleming.[2,3] Visual learners learn by visual input through figures, maps, films and diagrams. Aural learners prefer learning by listening to lectures, speeches, and discussions. Individuals in Rea/Write group learn better by absorbing materials from reading books, course notes, summaries etc.[4,5] Kinaesthetic learners learn by touching, experiencing physical actions, and working with their hands. VARK learning style is one of the popularly used systems and is of practical value and evaluated in the population of medical students.[6,7]

Recognition of learning styles acquires special significance in any group of trainees. The training programs tailored to the learning styles may help improve the outcome, measured by the trainees' performance in their tests.[8,9] It is important to devise programs to help students to absorb most of the material in the shortest possible time and to retain it to achieve a better outcome.[10] This is particularly true for medical students who have to acquire much factual and theoretical knowledge before becoming practising practitioners. There may be regional and social differences among various groups. We designed this study to find out whether any particular learning style was associated with the improved performance outcome, as judged by the grades acquired in annual tests in our medical students.

METHODOLOGY

The cross-sectional study was conducted at Mohtarma Benazir Bhutto Shaheed Medical College,

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Mirpur Azad Jammu and Kashmir, Pakistan, from June 2018 to June 2019. The study was approved by the Science Research Committee and Committee of Ethical Consideration (approval letter NO: 07-08/MBBS/ ACADEMIC/2018).

Inclusion Criteria: Students of third and fourth years of the MBBS program were included in the study.

Exclusion Criteria: Non-consenting students were excluded.

All the study participants who consented to the study, received the VARK questionnaire version 7.1. The nature of the study was explained to the participants. The optional nature of participation, the confidentiality of the data, and the option to withdraw at any time were explained and reassured. The students were asked to complete the provided question-naire forms and submit these in the same class within two hours. The performance grades, in the form of marks obtained in the annual test, were obtained from the Students' Department of the college. The results of the final exams indicated low achievers and high achievers. The cut-off was 50 out of 100 marks. Anyone securing less than 50% was categorized as low-achiever.

Table-I showed the distribution of learning styles among the participants. The study showed a mixture of students with uni- and multi-modal learning styles. One hundred and four students preferred unimodal learning styles, comprising 52% of the participants. Among the remaining 96(48%) students, the learning style was bimodal in 67(33.5%) and trimodal in 29 others (14.5%). In the Uni-modality group, the VARK subdivisions were such: Six students (6%) preferred visual learning, 42(21%) preferred aural learning, 26 students (13%) preferred reading/writing, and there were 30 students (15%) in the kinaesthetic group. Aural learning style was preferred by both male and female students. The preference for learning styles by each gender group is also shown in Table-I. More male students preferred unimodal and trimodal learning styles (62.7% and 44.8% of total male students) than female students (46% and 12%, respectively, of total male students). However, the Bimodal learning style was more prevalent in female students (41.4% versus 17.9%). Figure-1 showeds the distribution of various VARK learning styles in the unimodal group. Most students preferred aural learning (n=42, 21% of the total). The distribution of other learning styles in the unimodal group was such: visual 3% (n=6), read/write 13% (n=26) and kinaesthetic 15% (n=30).

Table-I: Learning Styles and Academic Achievements as related to the Learning Styles (n=100)

Variables		Unimodal				Modality			
		V	A	R	K	Unimodal	Bimodal	Trimodal	Multimodal
No. of students	200	6(3)	42(21)	26(13)	30(15)	104(52)	67(33.5)	29(14.5)	96(48)
Gender									
Male	67	3(4.5)	15(22.4)	14(20.9)	10(14.9)	42(62.7)	12(17.9)	13(44.8)	25(37.3)
Female	133	3(2.3)	27(20.3)	12(9)	20(15)	62(46.6)	55(41.4)	16(12)	71(53.3)
Overall Performance									
High	145	4(2.8)	25(17.2)	21(14.5)	21(14.5)	71(49)	50(34.5)	24(16.6)	74(51)
Low	45	2(3.6)	17(30.9)	5(9.1)	9(16.4)	33(60)	17(30.9)	5(9.1)	22(40)
Grade Average		55.5	51.7	57.6	52.3	53.6	53.6	59.2	

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to find out the association.

RESULTS

All students responded to the questionnaire with a response rate of 100%. There were 100 participants from each batch of the 3rd year and 4th year of medical college. One hundred forty-five students scored high, whereas 55 scored low, making 77.5% and 22.5% of the total participants.

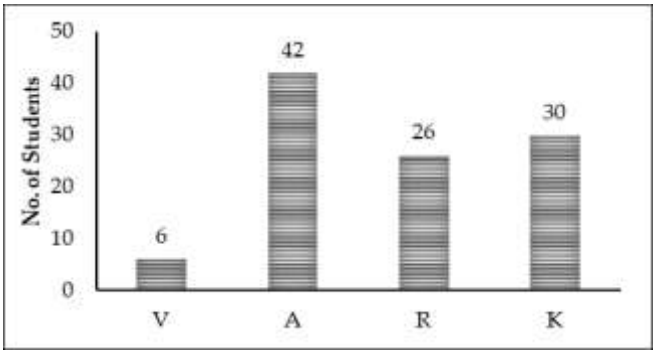

Figure-1: VARK (Visual, Aural, Read/Write, Kinaesthetic) Distribution of the Uni-Modality Subgroup of the whole group of students (n=100)

The academic achievements of the students in the study are depicted in Figure-2. High scorers were prevalent in all groups of learning styles, being 68.2% (n=71), 74.6% (n=50), 82.8% (n=24) and 77.1% (n=74) in unimodal, bimodal, trimodal and multi-modal groups respectively. Within the uni-modality group, high-achievers made up 66.7%, 59.5%, 80.7%, and 70% of the groups of visual, aural, read/write and kinaesthetic learning styles, respectively.

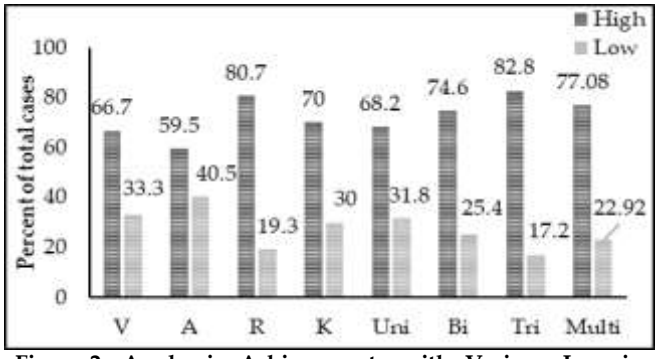

Figure-2: Academic Achievements with Various Learning Styles (n=100)

The learning styles of high- and low achievers did not show any correlation with gender. The learning styles of female high-achievers were not different from female low-achievers, and the same was true for male students. Among the high-achievers, unimodal or multi-modal learning styles did not reveal any statistically significant difference in the resulting grades, the *p*-value being 0.41. There was no significant statistical difference in various subgroups as for as the achievement is concerned. There was no significant difference in the types of learning styles among the groups of high-achievers and low-achievers. Table-II compares academic achievements in terms of actual marks (grades) obtained by high-achiever students with preferred learning styles. There was no significant relationship with any preferred learning styles, as shown by the *p*-values.

Table-II: Statistical Comparison of Various Learning Styles as related to Academic Achievements (n=100)

Learning Styles	n	Grades			*p*-value
		Mean±SD	95% Confidence Interval	Range	
Visual	6	55.5±15.7	39-72	30-68	0.26
Aural	42	51.7±13.0	47.7-55.8	32-74	
Reading /Writing	26	57.6±11.2	53.0-62.1	28-74	
Kinaesthetic	30	52.3±11.9	47.8-56.7	28-70	
Unimodal	104	53.6±12.5	51.1-56-0	28-74	0.06
Bimodal	67	53.6±11.9	50.7-56.5	28-72	
Trimodal	29	59.2±9.9	55.4-63.0	36-72	

DISCUSSION

Our study showed that the learning styles had no relationship to academic achievements in undergraduate medical students.

The studies of preferred learning styles in medical studies have yielded equivocal results. In a study by Hernández-Torrano *et al*. in 2017 on first-year medical students, students reported a preference for visual (80.8%) learning style,[6] suggesting that these students preferred to learn through demonstrations and diagrams. However, the aural mode was the dominant unimodal learning style in another study by Rezigalla *et al.* on medical students at the College of Medicine, University of Bisha.[7] In a recent Indian study by Hoh *et al.* most medical students out of 157 participants preferred a unimodal learning style. In the unimodality group, 40.8% preferred aural learning style.[8] The results from these studies compare well with our findings in the present study. However, other studies are reaching different conclusions. A study from Saudi Arabia by Aldosari *et al.* used the VARK questionnaire to explore the preferred learning styles of dental students. Most dental student participants were found to have a multi-modal learning style preference.[9] In another study of 146 medical students by Bin *et al.*, 70% of the respondents preferred the multi-modal learning style, with the remaining 30% having a unimodal style preference. The most preferred unimodal styles were the aural (A) and kinaesthetic (K) styles.[10]

Our study showed that preference for learning style is not related to academic outcome. This con-clusion is consistent with previous studies. For example, previous studies which used the VARK questionnaire to explore the relationship of preferred learning style to the outcome and concluded that performance in anatomy was not correlated with their score in any VARK categories.[11-13] In another study on dental students by Mozaffari *et al*. the students were categorized as "strong" or "weak" depending on their performance.[14] The most common learning styles in strong students were unimodal (n=55, 42%) and bimodal (n=41, 31.3%), while they were unimodal (n=28, 47.2%) and bimodal (n=24, 45.3%) in the weak students. The two groups of strong and weak students had no significant relationship between learning styles and academic achievement.

In contrast, in the study from Saudi Arabia by Aldosari *et al*. the dental students with a preference for a multi-modal learning style achieved better academic results.[9] These findings are quite in contrast to our

results in the present study. An analysis of the relevant 415 studies by Childs-Kean *et al.* found that the utility of various learning styles for predicting the outcome could be stronger. This analysis explored multiple learning style frameworks, including VARK, Kolb Learning Style Questionnaire and Pharmacist Inventory of Learning Styles.[15] Only two studies have found a significant correlation between a VARK preference and a learning outcome conducted by Kim, Gilbert, Paiboonsithiwong and colleagues. Kim and Gilbert surveyed 62 applicants to a general surgery residency program. They found that medical students with an aural learning preference performed better on the United States Medical Licensing Examination Step 1 and Step 2 compared with medical students with a kinaesthetic or multi-modal learning preference.[16]

Our study does not include medical students from other levels of medical education in medical colleges. They may differ in preferences of learning styles. For example, first-year medical students are more stressed due to the change in academic atmosphere from school to university, huge increase in academic burden and acquiring new social attitudes with new colleagues. Similarly, final-year students are more confident working in a hospital environment. We need a clear idea of how these factors affect preferred learning styles. This is important to address whether teaching methods for students of earlier levels should be different than for students at later levels. Learning styles are not fixed and may change over time when students progress in their careers.[17] The preference for a learning style is a dynamic feature and difficult to study in a cross-sectional study, and a longitudinal cohort study may be more rewarding. Similar points were raised earlier in a comment on the study by Khanal *et al.*[12] The learning style is not static throughout the age of the individual. It may not stay uniform throughout learning in medical school. The differing demands of the curriculum in a medical school, evolving from theoretical foundation to more practical application, may necessitate the dominance of one form of learning style over others, as outlined in previous studies.[17,18] Other specific study strategies (irrespective of VARK results), such as using the virtual microscope, may also positively correlate with final class grades. These data support the opinion that individual student learning styles contribute little too academic performance in medical students. Further studies may help to explore other factors which are to be considered when designing better teaching protocols.

CONCLUSIONS

Our study shows that the learning styles had no relationship to academic achievements in undergraduate medical students.

Conflict of Interest: None.

Author's Contribution

Following author has made substantial contributions to the manuscript as under:

ANK: Conception, study design, data acquisition, data analysis, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Author agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Romanelli F, Bird E, Ryan M. Learning styles: a review of theory, application, and best practices. Am J Pharm Educ 2009; 73(1): 9. doi: 10.5688/aj730109.
2. Fleming ND, Mills C. Not another inventory: rather a catalyst for reflection. In: Wulff DH, Nyquist JD; Professional and Organizational Development Network in Higher Education, editors. To improve the academy: resources for faculty, instructional and organizational development. Stillwater (OK): New Forums Press; 1992, [Internet] available at: https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1245&context=podimproveacad
3. Fleming ND. I'm different; not dumb: Modes of presentation (V.A.R.K.) in the tertiary classroom. Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia (HERDSA) version-18, [Internet] available at: https://www.vark-learn.com/wp-content/uploads/2014/08/different_not_dumb.pdf
4. Leite WL, Svinicki M, Shi Y. Attempted Validation of the Scores of the VARK: Learning Styles Inventory With Multitrait–Multimethod Confirmatory Factor Analysis Models. Educ Psychol Measur 2010; 70(2): 323-339. doi:10.1177/00131644093445.
5. Urval RP, Kamath A, Ullal S, Shenoy AK, Shenoy N, Udupa LA. Assessment of learning styles of undergraduate medical students using the VARK questionnaire and the influence of sex and academic performance. Adv Physiol Educ 2014; 38(3): 216-220. doi: 10.1152/advan.00024.2014.
6. Hernández-Torrano D, Ali S, Chan CK. First year medical students' learning style preferences and their correlation with performance in different subjects within the medical course. BMC Med Educ 2017; 17(1): 131. doi: 10.1186/s12909-017-0965-5.
7. Rezigalla AA, Ahmed OY. Learning style preferences among medical students in the College of Medicine, University of Bisha, Saudi Arabia (2018). Adv Med Educ Pract 2019; 10: 795-801. doi: 10.2147/AMEP.S219176.
8. Hoh JM, Kumar H, Shaun LQ, Sellapan M, Tay CC. A Cross-sectional Study on Learning Preferences for Research Methodology among Medical Students. J Assoc Physicians India 2019; 67(12): 18-21.
9. Aldosari MA, Aljabaa AH, Al-Sehaibany FS, Albarakati SF. Learning style preferences of dental students at a single institution in Riyadh, Saudi Arabia, evaluated using the VARK questionnaire. Adv Med Educ Pract 2018; 9(1): 179-186. doi: 10.2147/AMEP.S157686.

10. Bin Eid A, Almizani M, Alzahrani A, Alomair F, Albinhamad A, Albarrak Y, et al. Examining Learning Styles with Gender Comparison Among Medical Students of a Saudi University. Adv Med Educ Pract 2021; 12: 309-318. doi: 10.2147/AMEP.S295058. Erratum in: Adv Med Educ Pract 2022;13:593-594.
11. McKenna L, Copnell B, Butler AE, Lau R. Learning style preferences of Australian accelerated postgraduate preregistration nursing students: A cross-sectional survey. Nurse Educ Pract 2018; 28(1): 280-284. doi: 10.1016/j.nepr.2017.10.011.
12. Khanal L, Giri J, Shah S, Koirala S, Rimal J. Influence of learning-style preferences in academic performance in the subject of human anatomy: an institution-based study among preclinical medical students. Adv Med Educ Pract 2019; 10(1): 343-355. doi: 10.2147/AMEP.S198878.
13. O'Mahony SM, Sbayeh A, Horgan M, O'Flynn S, O'Tuathaigh CM. Association between learning style preferences and anatomy assessment outcomes in graduate-entry and undergraduate medical students. Anat Sci Educ 2016; 9(4): 391-399. doi: 10.1002/ase.001600.
14. Mozaffari HR, Janatolmakan M, Sharifi R, Ghandinejad F, Andayeshgar B, Khatony A. The Relationship Between the VARK Learning Styles and Academic Achievement in Dental Students. Adv Med Educ Pract 2020; 11(1): 15-19.
15. Childs-Kean L, Edwards M, Smith MD. Use of Learning Style Frameworks in Health Science Education. Am J Pharm Educ 2020; 84(7): ajpe7885. doi: 10.5688/ajpe7885.
16. Kim RH, Gilbert T. Learning style preferences of surgical residency applicants. J Surg Res 2015 ;198(1):61-65. doi: 10.1016/j.jss.2015.05.021.
17. Paiboonsithiwong S, Kunanitthaworn N, Songtrijuck N, Wongpakaran N, Wongpakaran T. Learning styles, academic achievement, and mental health problems among medical students in Thailand. J Educ Eval Health Prof 2016;13:38. doi: 10.3352/jeehp.2016.13.38.
18. Bhalli MA, Khan IA, Sattar A. Learning Style of Medical Students and Its Correlation with Preferred Teaching Methodologies and Academic Achievement. J Ayub Med Coll Abbottabad 2015; 27(4): 837-842.