

LEARNING STYLE PREFERENCES AMONG UNDERGRADUATE MEDICAL STUDENTS OF LAHORE, PAKISTAN: A CROSS-SECTIONAL STUDY

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Abstract

Background and Objectives: Learning styles is one of the key predictor for academic success of students. This study was conducted with objectives to assess the learning styles of medical students using the VARK Questionnaire and to study factors related to their learning style preferences.

Methods: A descriptive cross-sectional study, using the validated 16-point VARK Questionnaire Version 8.01, was conducted among medical students in Lahore, Pakistan, from May to October 2023. Through non-probability virtual snowball sampling, 360 students from various medical colleges responded to online Google forms distributed via emails and WhatsApp groups. Data were entered, cleaned, and analyzed using Statistical Package for the Social Sciences (SPSS) Version 26. The Chi-square test determined associations between variables, with a significance level set at $p < 0.05$.

Results: The respondents had a mean age of 21.56 ± 1.608 . The study found that 68.9% preferred a unimodal learning style, with visual (25%) being the most favored, followed by read/write (15.2%), aural (14%), and Kinesthetic (13.5%). No statistically significant relationships were found between learning style and gender, clinical year, schooling background, or institute type. However, significant relationships were found with age, academic performance, and preferred teaching methodology ($p=0.05$, $p=0.04$, and $p=0.007$, respectively).

Conclusion: The present study highlighted the independence of learning styles from demographics. The identified relationship between learning styles, preferred teaching methodologies, and academic performance emphasizes the significance of this knowledge for medical educators and students in fostering lifelong learning. It is noteworthy that majority of students demonstrated unimodal sensory preferences, reinforcing the importance of tailored teaching strategies to maximize learning potential.

Keywords: Learning, style, VARK, Medical Education, Teaching Methods, Medical Students

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Academic achievement stands out as a key predictor of learners' future academic success and among the various factors influencing academic achievements, learning styles play a significant role.¹ A learning style involves a blend of cognitive, emotional, and

physiological traits, offering insights into how a learner perceives and engages with the learning environment. Recognizing these learning styles is effective in structuring and adapting the learning environment, thereby enhancing both teaching and learning processes for individuals.¹⁻³ Scholars have long associated learning styles with human senses.^{3,4}

Learning style preference involves an intricate process of effectively perceiving, processing, storing, and retrieving the information students aim to learn.⁵ Various models exist for assessing learning styles, including Honey and Mumford's, Fleming's VARK, and Kolb's learning model.^{5,6} These models are ground-

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ded in diverse learning theories, concepts and psychology. The present study utilized the VARK model, proposed by Fleming, which is known for its simplicity, ease of understanding, and reliability.^{3,5,7,8} It incorporates four types of sensory modalities viz., visual (V), auditory/Aural (A), reading/ writing (R), and kinesthetic (K) which are consolidated in a 16 question, four point real-world scenarios based questions to discover sensory-based learning styles (V+A+R+K =VARK)*.^{7,8} He explained visual learners comprehend information through visual aids like graphs, figures, diagrams, handouts, and maps. Aural learners grasp concepts through auditory means such as lectures, discussions, and speeches. Reading/writing style learners absorb information by reading books, course notes, and taking notes. Kinesthetic learners, on the other hand, understand through tactile experiences, physical actions, and hands-on activities, such as dissection and clinical examinations.⁷ Students may employ unimodal, bimodal, trimodal, or quadrimodal methods to absorb information, depending on their individual learning style preferences.⁹ Additionally, Julia Wong and her colleague calculated reliability estimates for the visual, aural, read/write, and kinesthetic subscales, yielding scores of 0.73, 0.79, 0.84, and 0.69, respectively. These values suggest sufficient reliability within the studied population group.³

Medical Education and curriculum is ever dynamic. Its evolving landscape, driven by the requirements of accreditation agencies, societal needs, and technological advancements, underscores the crucial necessity of understanding learning styles.⁶

In the field of medical sciences where students must absorb extensive knowledge for application in clinical settings, efficient learning techniques that promote long-term retention are essential for lifelong learning.¹⁰ The recent pandemic has left medical education in Pakistan in a state of bewilderment, underscoring the imperative to overhaul its education system. Despite a swift shift towards online and blended (part online, part on-campus) learning, students have largely clung to textbooks as their primary source of acquiring new knowledge within the parameters of the traditional

education system. While many medical institutes still rely on didactic teaching methods, there is a continuous effort to integrate more interactive elements, including interactive lectures, model demonstrations, lab work, one-way lectures, and student presentations.^{10,11}

In relation to preferred teaching approaches, the study intends to investigate potential associations between learning styles, gender, clinical year, academic success, and kind of schooling (private or public). The objectives of the study were to assess the learning styles of medical students using the VARK Questionnaire and to study factors and outcomes related to their learning style preferences.

METHODS

This was a descriptive cross-sectional study that was conducted online across multiple private and public undergraduate medical colleges of Lahore from February 2023 till October 2023. The study incorporated a sample size of 360 students, determined using the formula: $n = z^2 \times p(1-p)/d^2$ where 60.69%¹¹ of students preferred multimodal learning style. All medical college students attending public or private medical institute in the undergraduate MBBS degree programme, Lahore were included in the study through non-probability convenient sampling using the virtual snow-ball sampling technique. Students from undergraduate dental programme were excluded. An online pre-tested, close ended questionnaire (Google form) including consent form was, administered via WhatsApp and emails. Multiple messages were circulated WhatsApp groups of students. Duplication of filling was avoided through google forms options. The questionnaire consisted of sociodemographic details, information about their educational background and the result mentioned on their last professional exam report card and link to VARK webpage.^{7,8,11} The VARK questionnaire comprises 16 multiple-choice items designed to identify four distinct learning styles. Each item corresponds to a specific style, and respondents select options based on their preferences. In cases where a single choice doesn't fully capture their perspective, respondents can choose

multiple options or leave items unselected. Higher scores within each learning style category indicate a stronger preference for that particular style. If an individual scores equally in two or more styles, they are classified as having a "multimodal" learning style.¹ The total score for each item ranges from zero to 16, providing a quantitative measure of the respondent's inclination toward each learning style.

Academic Performance is taken as the percentages achieved by students in their last Professional Examination will be converted to grades as follows: A(80-89%), B(70-79%), C(60-69%), D(59% and below). Further, for analysis purpose academic performance was composite into weak and stronger performance. Grade A and B were categorized as Strong academic performance and Grade C and D.¹² Teaching methodology included methods commonly employed in Medical Education including the following: Interactive lectures, small group discussions, demonstration on models, self-study, lab work, one way lecture.¹¹

Data were cleaned and screened for inaccuracies. Analysis was done by using Statistical Package for Social Science (SPSS) software version 26 and Microsoft Excel. Descriptive Statistics were used to calculate mean age and frequencies and percentages of qualitative variables such as type of learning modularity were used. Chi square test was used to find associations between participants' VARK learning style and their genders, public and private schooling backgrounds, private or public medical institute, academic years, academic performances, and preferred teaching methodologies. P value <0.05 was considered statistically significant. During the data collection process, the anonymity and confidentiality of the sub-jects was maintained

RESULTS

In this study, 46(12.80%) students were from first year, 99(27.5%) were second year students, 59(16.4%) were from third year, 127 (35.3%) were fourth year, 29 (8.1%) were from final year. Older students preferred unimodal type. For teaching methodologies,

in descending order of their preference, 26.7% (n=102) of students preferred small groups discussion, 25.6% (n=92) preferred self-study, 21.4% (n=75) preferred interactive lectures, 17.5% (n=63) preferred demonstration on models, 4.7% (n=16) preferred one way lecture, and 4.1%(n=12) preferred lab work. A significant association of learning styles with academic performance of respondents and preferred teaching methodology was seen (p=0.04 and p=0.007 respectively). (Table 3)

Academic performance as per result of last professional examination; Grade A=80% or higher, Grade B=79-70%, taken as Strong Academic performance and Grade C=69-60%, Grade D=59-50% consolidated in Weak Academic Performance. (Table 3)

Table 1: Frequency Distribution of respondents according to Preference of Learning Styles using VARK (n=360)

| Learning Styles | | Frequency | Percentage |
|--|-------------------------|-----------|------------|
| Type of Preferred Learning Style using VARK | | | |
| Unimodal | Visual (V) | 93 | 25.6 |
| | Aural(A) | 51 | 14.0 |
| | Read/Write(R) | 55 | 15.2 |
| | Kinaesthetic (K) | 49 | 13.5 |
| | Total | 248 | 68.9 |
| Multimodal* | Bimodal | | |
| | V | 30 | 8.3 |
| | A,K | 7 | 1.9 |
| | V,K | 4 | 1.1 |
| | A,R | 3 | 0.8 |
| | R,K | 3 | 0.8 |
| | V,R | 1 | 0.3 |
| | Total | 48 | 13.3 |
| | Tri-modal | | |
| | V,A,K | 13 | 3.6 |
| | V,A,R | 8 | 2.2 |
| | V,R,K | 8 | 2.2 |
| | A,R,K | 3 | 0.8 |
| | Total | 32 | 8.9 |
| Quadra modal-VARK | 32 | 8.9 | |
| Total | 112 | 31.1 | |
| Total | 360 | 100 | |

*Using more than one mode of the learning styles
V= Visual, A=Aural, R=Reading/Writing, K=Kinesthetic

Table 2: Relationship of Learning Styles of respondents with their socio-demographic profile (n=360)

| Sociodemographic Profile | | Learning Styles | | P-value* |
|--|----------------------|-----------------------------------|-------------------------------------|--------------|
| | | Unimodal (n=248) Frequency (%) | Multimodal (n=112) Frequency (%) | |
| Gender | Male | 62 (68.9%) | 28(31.1%) | 0.5 |
| | Female | 186(68.9%) | 84(31.1%) | |
| Age | >21 years | 122(74%) | 43(26%) | 0.02* |
| | ≤21 years | 126(64.6%) | 69(35.4%) | |
| Range: 18-30 years, Mean 21.56 years±1.56, Median 22 years | | | | |
| Type of Medical Institute | Private | 72(72%) | 28(28%) | 0.429 |
| | Public | 176(67.69%) | 84 (32.30%) | |
| Schooling Background | Private school | 133(68.55%) | 61(31.44%) | 0.970 |
| | Public school | 68(68.68%) | 31(31.31%) | |
| | Both | 47(70.14%) | 20(29.85%) | |
| Academic year | Preclinical clinical | 103(71.03%) | 42(28.96%) | 0.470 |
| | Clinical | 145(67.44%) | 70(32.5%) | |

*Significant p values (Chi-Square test was used). Row percentages used

Table 3: Relationship of Learning Styles of respondents with their academic performances and preferred teaching methodologies (n=360)

| Characteristics | | Learning Styles | | P value |
|--------------------------------|-----------------------------|---------------------------------|-----------------------------------|---------------|
| | | Unimodal n=248 Frequency (%) | Multimodal n=112 Frequency (%) | |
| Academic Performance | Weak Academic Performance | 103 (75.18%) | 34 (24.8%) | 0.043* |
| | Strong Academic Performance | 145 (65.02%) | 78(34.9%) | |
| Preferred Teaching methodology | Self-study | 74 (80.43%) | 18 (19.5%) | 0.007* |
| | Small Group Discussion | 72 (70.58%) | 30 (29.4%) | |
| | Lectures | 60 (65.9%) | 31 (34.06%) | |
| | Practical Work | 42 (56%) | 33 (44%) | |

*p-value <0.05 taken as significant. Row percentages used

DISCUSSION

This study shows that majority of the students, both male and female, (68.9%) prefer unimodal learning style. Similar results were found by Mehdipur et al. where 86% students preferred single learning style with aural being most prominent.¹³ Other studies also showed a dominating unimodal preference among students.^{9,10,14,15} Aldosri and his colleague,¹⁵ showed that 63.4% (Chauhan et al.)¹⁷ 53.3% and (Fahim et al.)¹¹ showed 60.2% of students in medical and dental colleges of EMRO region preferred multi-modal learning style. Similar results were shown in various studies where majority of medical students prefer multimodal learning styles.^{15,18} Rezigalla and his colleagues argue that students tend to shift from multimodal learning styles to unimodal learning in

later years of the medical education. The distribution of unimodal learning styles demonstrates a gradual shift from kinesthetic (K) to auditory (A) and visual (V).⁹ In contrast, Chaudhary et al concluded that learners tend to favor multimodal learning styles, suggesting an adaptability to various methods due to their enhanced learning skills. This discrepancy emphasizes the importance of periodically reassessing students' learning styles, particularly in advanced academic years, to ensure instructional approaches are well-aligned with evolving preferences and needs.¹⁹ According to the VARK inventory, global student preferences for multimodal (bimodal) learning styles varied from 13.2% in Saudi Arabia to 87% in Iran, with kinesthetic preferences constituting 70%. In Pakistan unimodal learning varies from 27.6% to

38%.²⁰ This study, however, showed the highest percentage of unimodal preferences (68.9%) with visual being 25.6%. This contrasted with other studies that commonly identify kinesthetic or aural as the predominant learning style among medical students.^{14,17,21,22} The shift in the predominant preference of medical students from auditory (A) to visual (V) or kinesthetic (K) learning might be attributed to the rising prevalence of online learning.¹¹ Alfarsi et al. showed different bimodal learning preferences with VK, AK, RK, VA, and RK in descending order. Further, tri and quadmodal learning styles were 16.4% and 6.2% respectively. This is in contrast to this study, where trimodal and quadmodal learning style inclinations were similar (8.9% in both) with VAK being the most preferred learning style.²¹ Fahim et al showed that 21.8% students preferred quadmodal learning style¹¹ while Rezigalla et al⁹ and Chouhan¹⁷ showed that medical students preferring VARK were negligible (0 and 0.01% respectively). These findings highlighted the diverse learning preferences within the medical student across the nations, making it inevitable of medical educations to adapt to a range of teaching methods in order to enrich the overall learning experience.⁴

The study included students from both clinical and pre-clinical years. Unexpectedly, both subsets preferred unimodal styles of learning. No significant association between learning styles and year of study of medical students was demonstrated like others.²³

Individuals exhibit significant variation in their learning processes, each adopting a distinct style influenced by cognitive disparities and the learning context and it can affect their academic performances.^{9,17} In contrast to this study, Rezigalla demonstrated that highest achievers were in unimodal learning style. Although no significant association between academic performance and respondents' learning styles by him and Chaudhary and his co-workers.^{9,19} This study, however, depicted that weak academic performance was related to unimodal learning style (p value=0.045) and these findings underscore a substantial portion (61.9%) of respondents demonstrate commendable

academic achievement (Grade A and B). However, Chaudhary et al. also demonstrated notable impact of learning styles on academic performance was observed among third-year students, fourth-year students, and house officers, indicating a statistically significant relationship in these specific academic levels.¹⁹ Understanding students' preferred teaching methodologies is crucial in tailoring the medical education curriculum. Although, there is no inherent superiority or inferiority in any single learning style, recognizing and accommodating these differences contributes to the potential for a more effective and inclusive educational experience.

In analyzing socio-demographic profiles, variables such as age, gender, background schooling, and the type of medical institute were taken into account. The study did not uncover any significant associations between gender, background schooling, and the type of medical institute with the learning style. This is different from findings of Madgy and colleagues,²⁴ and Fahim et al.¹¹ where gender exhibited a notable connection with learning styles. In their work, Magdy showed that male preference for multimodal learning while Fahim et al showed females had higher probability of choosing multi modal learning style (RR= 2.37).^{11, 24} Age was found be significantly related to learning style. Similar predictions were made by Rezigalla and his colleagues where he argued that final year students were inclined towards unimodal learning style.⁹ It should be kept in the mind that above mentioned variables of sociodemographic profile could be taken as proxy for the socio-economic state as privately schooling and medical institutes are quite heavy on budget in Pakistan. Magdy also showed similar results with no relationship of schooling type, household income, parental educational background, and use of private lessons.²⁴

Recognizing students' learning styles is vital for aligning their behavior and effective educational experience.²⁵ Imparting a large amount of information to students in a limited amount of time is a monumental challenge¹⁰ and increasing awareness of learning

styles among students and teachers might allow for more effective learning and teaching practices.

The study also explored students' preferences for teaching methodologies. Notably, 26.7% favored small group discussions, 25.6% leaned towards self-study, 21.4% preferred interactive lectures, 17.5% favored demonstrations on models, 4.7% preferred one-way lectures, and 4.2% showed a preference for lab work. The study revealed a statistically significant relationship (p value=0.007) between learning style and preferred teaching methodology, suggesting that a uniform teaching approach may not be the most effective strategy particularly in post pandemic era.^{11,22} Tailoring teaching methods to accommodate diverse learning styles appears crucial for optimizing educational outcomes.

A similar study conducted by Muniyapillai T, et al¹ at teaching medical college in the Perambalur district of Tamil Nadu, India showed students preferred demonstrations (81.2%), followed by an interactive lecture (77.2%), as their preferred teaching methods. Alfarasi however, showed that majority students (64%) preferred clinical skill labs followed by interactive lecture (59%) and practical work (57%). Teaching methods wield significant influence over the learning process, and contemporary educators must leverage innovative educational technologies to meet the preferences of the tech-savvy students in the current generation.²¹

The study had its limitations. Omission of other learning inventories, the inability to incorporate a more diverse sociodemographic group, the challenge of establishing causality due to resource constraints and lack of representation of other dental, allied and post graduate students are some deficiencies. Addressing these limitations would necessitate future research involving longitudinal studies and larger sample sizes.

CONCLUSION

Both male and female medical students, in public and private medical institutes of Lahore were dominantly unimodal with preference for visual learning. A significant relationship identified

between the type of learning styles, academic performance and teaching methodology, highlighted the importance of incorporation of learning methods. Alignment of these preferences would be a step towards fostering student-centered, life-long learning experience.

Ethical Approval:

The ethical Approval was obtained from Fatima Jinnah Medical University, Lahore. (Reference No. 64/CIERB).

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REFERENCES

1. Muniyapillai T, Kulothungan K, Malik SRA, Jeevaraj SJ, Ashokan S, Ravichandran S, et al. Learning styles and their relationship with preferred teaching methodologies and academic achievement among medical students in teaching medical college, Tamil Nadu. *J Educ Health Promot.* 2023 Jan 1;12(1):256. Available from: <https://pubmed.ncbi.nlm.nih.gov/37727436/>
2. Bordoni N, Salgado PA, Argentieri Á, Squassi AF. Learning strategies of dental students in Buenos Aires, Argentina prior to and during the COVID-19 pandemic. *Acta Odontol Latinoam* [Internet]. 2022 Dec 19;35(3):214–22. Available from: <https://pubmed.ncbi.nlm.nih.gov/36748740/>
3. Wong JSW, Chin KCW. Reliability of the VARK questionnaire in Chinese nursing undergraduates. *US-China Education Review A.* 2018;8(8):332–40. doi:10.17265/2161-623x/2018.08.002
4. Nabizadeh S, Hajian S, Sheikhan Z, Rafiei F. Prediction of academic achievement based on learning strategies and outcome expectations among medical students. *BMC Med Educ.* 2019 Apr 5;19(1). Available from: <https://pubmed.ncbi.nlm.nih.gov/30953500/>
5. Karim R, Asaduzzaman AK, Talukder HK, Alam KK, Haque F, Khan SJ. Learning style preferences among undergraduate medical students: An experience from different medical colleges of Bangladesh. *Bangl J Med Educ* 2019;10:26-30.
6. Ballouk R, Mansour V, Dalziel B, McDonald J, Hegazi I. Medical students' self-regulation of learning in a blended learning environment: A systematic scoping review. *Medical Education Online.* 2022;27(1). doi: 10.1080/10872981.2022.2029336

7. Fleming N, Baume D. Learning Style Again: Varking up the Right Tree. United States: Educational Developments, SEDALtd; 2006. p. 4-7. Available from: <http://www.vark-learn.com/wp-content/uploads/2014/08/educational-developments.pdf>.
8. Fleming N. VARK a Guide to Learning Styles: Frequently Asked Questions. Christchurch: VARK Learn Limited; 2001-2013. Available from: <https://www.vark-learn.com/english/page.asp>.
9. 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; Volume 10:795–801. doi: 10.2147/amep.s219176 .PMID: 31565016; PMCID: PMC6735654.
10. Bokhari N, Zafar M. Learning styles and approaches among medical education participants. *J Educ Health Promot*. 2019; 18:181. Available from: <http://pmc/articles/PMC6796290/>
11. Fahim A, Rehman S, Fayyaz F, Javed M, Alam MA, Rana S, et al. Identification of Preferred Learning Style of Medical and Dental Students Using VARK Questionnaire. *Biomed Research International*. 2021;2021. Available from: <https://pubmed.ncbi.nlm.nih.gov/34708122/>
12. 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* [Internet]. 2020 [cited 2023 Nov 14];11:15. Available from: <http://pmc/articles/PMC6955605>
13. Mehdipour M, Mortazavi H, Yazdani J, Namdari M, Moradi M. Learning styles of dental students at Shahid Beheshti University of Medical Sciences using VARK questionnaire. *Iranian Journal of Medical Education*. 2018 Apr 10;18:176-82.
14. Ahsan A, Talat N, Fayyaz S. Exploring the preferred learning styles among undergraduate medical students and postgraduate residents by using VARK Inventory. *Health Professions Educator Journal* [Internet]. 2020 Jan 4 [cited 2023 Nov 18];3(1):24–30. Available from: <https://hpej.net/journals/medicaleducator/article/view/99>
15. Bin Eid A, Almutairi 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* [Internet]. 2021 [cited 2023 Nov 14];12:309. Available from: <http://pmc/articles/PMC8032450/>
16. 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;9:179–186. doi:10.2147/AMEP.S157686
17. Chouhan N, Shan R, Gupta M, Rashid S, Manhas M. Evaluation of preferred learning styles among undergraduate students of Government Medical College, Jammu. *Natl J Physiol Pharm Pharmacol* [Internet]. 2023 Mar 1 [cited 2023 Nov 14];13(3):574–574. Available from: <https://www.njppp.com/?mno=90877>
18. Learning Style Preferences of First-year Undergraduate Medical College Students; Assessment using VARK Strategy| *Himalayan Journals* [Internet]. [cited 2023 Nov 14]. Available from: https://himjournals.com/articles/657_Learning_Style_Preferences_of_First_year_Undergraduate_Medical_College_Students_Assessment_using_VARK_Strategy
19. Chaudhry NA, Ashar A, Ahmad SA. Association of Visual, Aural, Read/Write, And Kinesthetic (VARK) learning styles and academic performances of dental students. *Pakistan Armed Forces Medical Journal*. 2020 Jan 27;70(Suppl-1):S58-63.
20. Shakeri F, Ghazanfarpour M, MalaKoti N, Soleimani Houni M, Rajabzadeh Z, Saadat S. Learning Styles of Medical Students: A Systematic Review. *Med Edu Bull* 2022; 3(2): 441-56. DOI: 10.22034/MEB. 2022. 328652.1050
21. Alfarsi W, Elaghoury AH, Kore S. Preferred Learning Styles and Teaching Methods Among Medical Students: A Cross-Sectional Study. *Cureus* 15(10): e46875. doi: 10.7759/cureus.46875
22. Subagja S, Rubini B. Analysis of Student Learning Styles Using Fleming’s VARK Model in Science Subject. *Jurnal pembelajaran dan biologi nukleus*. 2023 Mar 7;9(1):31–9.
23. Minhas R, Shahid N, Gulzar Z, Zafar S, Shahzad S. Assessment of Ideal Learning Style among Medical Students using VARK Learning Approach. *Journal of Bahria University Medical and Dental College* [Internet]. 2022 Jul 4 [cited 2023 Nov 14]; 12(03): 157–61. Available from: <https://jbumdc.bahria.edu.pk/index.php/ojs/article/view/949>
24. Magdy H, El-Masry R, Alwerdani MM, Abd-Elhamid SA, Nafeh A. Learning Styles of Undergraduate Medical Students: Effect of Socio-Demographic and Educational Background Characteristics. *WJMER*. 2021; 70(1):15-24.
25. Muluk S, Habiburrahim H, Rechal SR. Students’ awareness and perception towards learning styles. *Jurnal Ilmiah Didaktika: Media Ilmiah Pendidikan dan Pengajaran*. 2020;20(2):143. doi: 10.22373/jid.v20i2.5229