

ISSN (P): 2788-9815
ISSN (E): 2788-791X

JM
L&P
HEALTH

Vol. 5 No. 4 (2025): Oct-Dec



Submitted: 27/03/2025
Accepted: 02/08/2025
Published: 12/09/2025

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Article Link: <https://jmlph.net/index.php/jmlph/article/view/215>

DOI: 10.52609/jmlph.v5i4.215

Citation: Mishra, S., Guria, J., V, P., & Mishra, A. (2025). Assessment of Learning Style Preferences Among Medical Students and Their Correlation with Academic Performance in First-Year MBBS Subjects. *The Journal of Medicine, Law & Public Health*, 5(4), 791–800. <https://doi.org/10.52609/jmlph.v5i4.215>

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Assessment of Learning Style Preferences Among Medical Students and Their Correlation with Academic Performance in First-Year MBBS Subjects

Srishti Mishra, Jyotish Guria, Poovaragavan V, Ashim Mishra

Abstract—Background: Learning styles represent different approaches to learning that can influence how effectively students assimilate information. The VARK model classifies learning styles into four modalities: Visual, Aural, Read/Write, and Kinaesthetic. Recognising students' preferred learning styles may help to optimise educational strategies, particularly in demanding fields such as medical education.

Aim: This study aimed to identify the predominant learning style preferences among first-year MBBS students and to evaluate any associations between these preferences and their academic performance.

Methods: A cross-sectional survey was conducted among second- and third-year medical students who had completed their first-year MBBS examinations. Data on age, sex, and subject-specific marks were collected, and the VARK (Version 8.01) questionnaire was administered to determine individual learning style preferences. Statistical analyses compared the distribution of preferred learning style by sex and by academic achievement, with significance assessed using appropriate software.

Results: Among 126 participants (70 females, 56 males), quadmodal (multimodal) was the most commonly reported preference (33.3%), followed by unimodal (33.3%), bimodal (16.7%), and trimodal (16.7%) learning styles. The kinaesthetic modality was the predominant unimodal preference. No significant differences in learning style distribution were observed between male and female students. Academic performance did not significantly correlate with any specific learning style; high and low

performers exhibited similar distributions of learning preferences.

Conclusion: Multimodal learning styles are the most prevalent among first-year MBBS students, and there is no significant association between learning style preference and academic achievement. These results underscore the value of incorporating diverse teaching methods to accommodate various learning preferences within the medical curriculum.

Index Terms—Academic Performance; Learning; Sensory Modality; VARK.

I. INTRODUCTION

Learning is a dynamic and individualized process by which individuals acquire new knowledge, develop skills, form behaviours, and deepen their understanding. In the context of higher education—especially in demanding fields such as medicine—how students learn is just as important as what they learn. Each learner has unique preferences and strategies that influence how they engage with and assimilate information. Often referred to as learning styles, these preferences can differ widely among individuals and are influenced by several factors including cognitive ability, personality traits, and prior educational experiences. Furthermore, learning style preferences are not fixed: they can vary depending on the subject matter, the complexity of the information, and the pedagogical methods employed by instructors [1]. In medical education, where students are expected to master a broad spectrum of subjects understanding how students prefer to learn becomes crucial. Matching teaching strategies to students' preferred learning styles has the potential to enhance comprehension, retention, and overall academic performance [1]. Different models have been developed over time to classify students' various approaches to learning and their perceptions of the teaching-learning environment [2]. VARK is one model, introduced in 2006 by Neil Fleming, which uses a questionnaire to classify individuals' sensory learning preferences into four styles: Visual (V), Aural (A), Read/write (R), and Kinaesthetic (K) [3].

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DOI: 10.52609/jmlph.v5i4.215

Visual learners (V) prefer a visual representation of information, through graphical representations that may include maps, diagrams, flowcharts, graphs, and symbols, but do not include still pictures, videos, or slides. Aural learners (A) give particular attention to the words they hear during the process of information delivery. Their preference is to listen, rather than take detailed lecture notes. They like discussions, seminars, and listening to recorded lectures. Aural learners can retain information through reading aloud, or even low-volume mouthing while reading. Read/Write learners (R) prefer reading printed texts such as textbooks, lecture notes, handouts, essays, reports, journals, etc. They are keen note-takers. Lastly, kinaesthetic learners (K) prefer hands-on experience through practical and real-life applications. They appreciate the use of models, mannequins, and simulations, with a preference for touch, movement, and interaction in their learning environment. Typically, kinaesthetic students are passive in the classroom setting [1]. Some overlap among these modalities always exists. A learner can have a multimodal preference that can range from bimodal to quadmodal within the VARK framework. Moreover, students' learning styles can also vary depending on the subject matter [1,3].

VARK underscores the idea that not everyone learns in the same way. Thus, to improve learning, we can tailor our strategies, rather than just trying harder, studying more, and so on [3]. Identifying students' preferred learning styles can help to enhance their learning environment [4]. The takeaway for teachers is that students do learn in different ways, and while it would be impractical to tailor their teaching materials to individual preferences, there are benefits to incorporating a variety of modalities into their lesson structure. These benefits can include reaching more students, providing more interesting content, and repeating concepts using different modalities and thus not boring the class [3].

While previous studies have been conducted to determine the learning preferences of students, none have examined the relationship between these preferences and students' performance in specific subjects. This study therefore aims to identify the learning preferences of university students who have completed their first-year MBBS examinations in different subjects, and whether such preferences are related to their academic performance.

II. MATERIALS AND METHODS

Second- and third-year students who had completed their first-year MBBS examinations were eligible for inclusion in the study. Participants were provided with a participation information sheet and informed consent forms, using Google Forms. All eligible students consenting to participate were included in the study, while those unwilling to participate were excluded. Prior to commencing the study permission and clearance were obtained from the Institutional Ethics Committee (MTMC/IEC/2023/22). Sample size was determined using a sample size calculator, based on a 30% prevalence of visual learning style reported by MBBS students in previous studies, with a precision level of 8%. Data collected from the consenting participants via Google Forms included age, gender, and marks obtained for first-year MBBS examinations on the subjects of Anatomy, Biochemistry, and Physiology. Participants used the latest version (Version 8.01) of the VARK questionnaire (Appendix-1), shared with them via a link, and submitted the result regarding their learning style preferences [5]. Confidentiality was strictly maintained with regard to the students' academic performance.

The distribution of learning style preferences was expressed as a percentage of students per category, while the scores of individual VARK components were expressed as means \pm SD. A comparison of VARK scores according to gender and academic performance in different subjects was done using Jamovi software (version 2.3.4).

III. RESULTS

The study included a total of 126 participants, of whom 70 (55.6%) were female and 56 (44.4%) male. The results of the VARK questionnaire were classified as unimodal, bimodal, trimodal, and multimodal (quadmodal), according to the individual, or combination of, reported modalities.

Quadmodal (including all four learning modalities) and unimodal scored equally as the most commonly reported learning styles, each preferred by 42 participants (33.3%). These were followed by bimodal and trimodal preferences in 21 participants (16.7%) each.

Kinaesthetic (K) was the most preferred sensory modality among the unimodal group, selected by 30 participants (23.8%), while Aural (A) and Read/write (R) were least preferred, by just 3 participants

Table 1. Gender-based distribution of preferred learning modalities

Modality		Gender		Total
		Male	Female	
Quadmodal	VARK	19	23	42
Trimodal	VAR	0	1	1
	VAK	7	3	10
	ARK	2	4	6
	VRK	2	2	4
Bimodal	AK	4	8	12
	VK	3	4	7
	RK	1	1	2
Unimodal	V	4	2	6
	A	1	2	3
	R	1	2	3
	K	12	18	30
Total		56	70	126

Table 2. Gender-based distribution of grades in the subjects of Anatomy, Physiology, and Biochemistry

Category	Gender	
	Male (% of total)	Female (% of total)
Physiology		
A	12 (9.5%)	28 (22.2%)
B	34 (27%)	35 (27.8%)
C	10 (7.9%)	7 (5.6%)
Total	56	70
Anatomy		
	Male (% of total)	Female (% of total)
A	22 (17.5%)	35 (27.8%)
B	28 (22.28%)	31 (24.6%)
C	6 (4.8%)	4 (3.2%)
Total	56	70
Biochemistry		
	Male (% of total)	Female (% of total)
A	33 (26.2%)	45 (35.7%)
B	19 (15.1%)	24 (19%)
C	04 (3.2%)	01 (0.8%)
Total	56	70

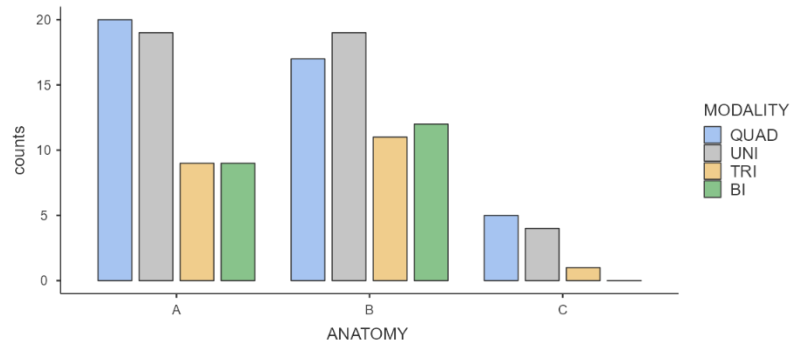


Figure 1. Modality-based distribution of grades in Anatomy
[UNI - Unimodal, BI - Bimodal, TRI - Trimodal, QUAD - Multimodal (Quadmodal)]

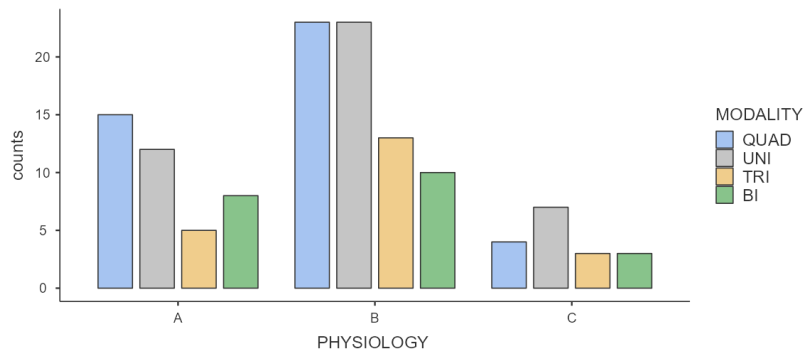


Figure 2. Modality-based distribution of grades in Physiology
[UNI - Unimodal, BI - Bimodal, TRI - Trimodal, QUAD - Multimodal (Quadmodal)]

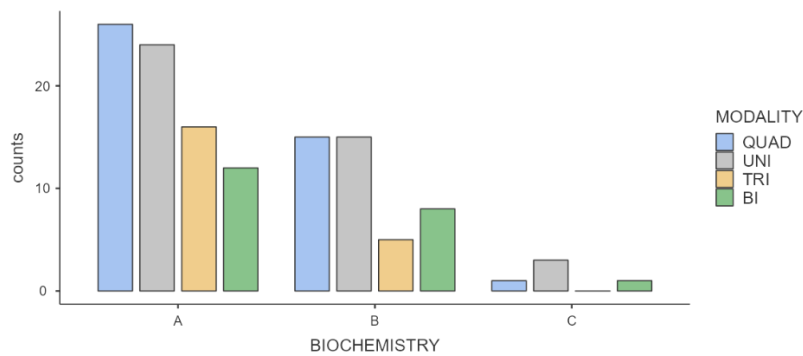


Figure 3. Modality-based distribution of grades in Biochemistry
[UNI - Unimodal, BI - Bimodal, TRI - Trimodal, QUAD - Multimodal (Quad modal)]

(2.4%) each. AK was the most preferred combination among the bimodal group, selected by 12 participants (9.5%), and VAK was most preferred in the trimodal group, by 10 participants (7.9%). VAR was the least preferred trimodal combination, reported by only one student. The gender-based distribution of preferred modalities is illustrated in Table 1.

The students' academic performance in the examined subjects was divided into three categories (A, B, and C) based on their marks, where category A represents a grade of 70% or higher (high performers), B represents grades of 60% to 69% (mid performers), and C represents grades below 60% (low performers). Table 2 shows the gender-based distribution of scores in individual subjects.

Figures 1-3 illustrate the distribution of grades according to preferred learning modality. There was no significant difference in preferred learning style between male and female students ($p > 0.05$), with quadmodal most prevalent in both (33.9% and 32.9%, respectively). Kinaesthetic was the highest unimodal preference for both male (21.4%) and female (25.7%) participants.

IV. DISCUSSION

Of the 126 participants, the majority demonstrated multimodal learning preferences, with quadmodal being most common, with a lower prevalence of trimodal and bimodal learners. This trend is consistent with the findings of previous studies. Urval et al [2] reported that 68.7% of students preferred multimodal learning styles, while Lujan and DiCarlo [6] found a 64% preference among first-year medical students. Similarly, Kharb et al [7] also documented a predominance of multimodal learning styles in their study. These findings suggest that most medical students favour integrated teaching approaches that stimulate multiple sensory modalities, rather than relying on a single mode of instruction.

Among the unimodal learners (33.3% of the total), the kinaesthetic modality was the most commonly preferred, accounting for 23.8% of the total sample. This result aligns with the findings of Joshi et al [8], who also identified kinaesthetic learning as the dominant preference among first-year medical students. Kinaesthetic learners benefit from active, hands-on experiences such as model demonstrations, roleplay, clinical skills laboratories, and other experiential learning strategies. These results underscore the need to incorporate such learning

methodologies into medical curricula, to cater to this population of learners. Gender-wise, no statistically significant difference was found in learning style preferences ($p > 0.05$), a result echoed by Urval et al [2], Baykan and Nacar [9], and Mlambo et al [10]. While quadmodal was the most commonly preferred style by both males and females (33.9% and 32.9%, respectively), kinesthetic was the leading unimodal preference in both genders (21.4% and 25.7%, respectively), highlighting a common learning orientation regardless of gender.

In analysing the relationship between learning styles and academic performance, no significant correlation was observed across scores for Anatomy, Physiology, and Biochemistry. This finding supports the findings of Urval et al [2], Baykan and Nacar [9], and Mlambo et al [10], which also conclude that learning style preference did not have a direct influence on academic performance. These studies emphasize that while understanding students' learning preferences can enhance engagement and satisfaction, it does not necessarily translate into higher academic achievement. However, this contrasts with studies by Samarakoon et al [11], Gangadharan et al [12], and Panahi et al [13], which reported a statistically significant association between learning style and academic achievement. These discrepancies could be due to differences in educational settings, sample sizes, cultural factors, or evaluation systems. Furthermore, it is notable that in this study, high performers and low performers were distributed across all learning styles, reinforcing the notion that academic success may depend more on factors such as prior preparation, study habits, motivation, and teaching quality, rather than learning style alone.

Despite its findings, this study is not without limitations. Firstly, the sample size was limited to 126 students from a single medical college, which restricts the generalizability of the results. Secondly, learning styles were self-reported using the VARK questionnaire, which may be subject to participant bias. Furthermore, due to the cross-sectional study design, data were captured at a single point in time, which does not account for how learning style preferences and academic performance might change over the course of medical training.

Notwithstanding its limitations, the study highlights practical strategies that can enhance educational approaches to medical training. Firstly, the predominance of multimodal learners suggest that

teaching strategies should be diversified. A combination of visual (diagrams,), auditory (lectures, discussions), read/write (notes, textbooks) and kinaesthetic (practical sessions, models) methods should be incorporated into lesson planning. Secondly, recognizing the higher proportion of kinaesthetic learners should reinforce the importance of hands-on training in the early years of medical education. Teachers should integrate more interactive sessions such as skill laboratories and roleplays, to cater to these learners. Lastly, while learning styles may not directly correlate with academic grades, raising awareness among students about their preferred style can help them adapt their academic strategies more effectively.

V. CONCLUSION

Multimodality is the most preferred learning style among the students who participated in this study. Learning style preferences were similarly distributed among high and low performers, and no significant relationship was found between preferred learning style and academic achievement in any subject. Further studies with larger sample sizes, including students from different medical colleges, can provide a better overview, and could serve as tools to understand the learning preferences of students among different institutions.

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APPENDIX 1: VARK questionnaire (Version 8.01)

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The VARK Questionnaire (Version 8.01)

How Do I Learn Best?

Choose the answer which best explains your preference and circle the letter(s) next to it.

Please circle more than one if a single answer does not match your perception. Leave blank any question that does not apply.

1. I need to find the way to a shop that a friend has recommended. I would:

- find out where the shop is in relation to somewhere I know.
- ask my friend to tell me the directions.
- write down the street directions I need to remember.
- use a map.

2. A website has a video showing how to make a special graph or chart. There is a person speaking, some lists and words describing what to do and some diagrams. I would learn most from:

- seeing the diagrams.
- listening.
- reading the words.
- watching the actions.

3. I want to find out more about a tour that I am going on. I would:

- look at details about the highlights and activities on the tour.
- use a map and see where the places are.
- read about the tour on the itinerary.
- talk with the person who planned the tour or others who are going on the tour.

4. When choosing a career or area of study, these are important for me:

- Applying my knowledge in real situations.
- Communicating with others through discussion.
- Working with designs, maps or charts.
- Using words well in written communications.

5. When I am learning I:

- like to talk things through.
- see patterns in things.
- use examples and applications.
- read books, articles and handouts.

6. I want to save more money and to decide between a range of options. I would:

- consider examples of each option using my financial information.
- read a print brochure that describes the options in detail.
- use graphs showing different options for different time periods.
- talk with an expert about the options.

7. I want to learn how to play a new board game or card game. I would:

- watch others play the game before joining in.
- listen to somebody explaining it and ask questions.
- use the diagrams that explain the various stages, moves and strategies in the game.
- read the instructions.

8. I have a problem with my heart. I would prefer that the doctor:
- a. gave me something to read to explain what was wrong.
 - b. used a plastic model to show me what was wrong.
 - c. described what was wrong.
 - d. showed me a diagram of what was wrong.
9. I want to learn to do something new on a computer. I would:
- a. read the written instructions that came with the program.
 - b. talk with people who know about the program.
 - c. start using it and learn by trial and error.
 - d. follow the diagrams in a book.
10. When learning from the Internet I like:
- a. videos showing how to do or make things.
 - b. interesting design and visual features.
 - c. interesting written descriptions, lists and explanations.
 - d. audio channels where I can listen to podcasts or interviews.
11. I want to learn about a new project. I would ask for:
- a. diagrams to show the project stages with charts of benefits and costs.
 - b. a written report describing the main features of the project.
 - c. an opportunity to discuss the project.
 - d. examples where the project has been used successfully.
12. I want to learn how to take better photos. I would:
- a. ask questions and talk about the camera and its features.
 - b. use the written instructions about what to do.
 - c. use diagrams showing the camera and what each part does.
 - d. use examples of good and poor photos showing how to improve them.
13. I prefer a presenter or a teacher 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, maps or graphs.
14. I have finished a competition or test and I would like some feedback. I would like to have feedback:
- a. using examples from what I have done.
 - b. using a written description of my results.
 - c. from somebody who talks it through with me.
 - d. using graphs showing what I achieved.
15. I want to find out about a house or an apartment. Before visiting it I would want:
- a. to view a video of the property.
 - b. a discussion with the owner.
 - c. a printed description of the rooms and features.
 - d. a plan showing the rooms and a map of the area.
16. I want to assemble a wooden table that came in parts (kitset). I would learn best from:
- a. diagrams showing each stage of the assembly.

- b. advice from someone who has done it before.
- c. written instructions that came with the parts for the table.
- d. watching a video of a person assembling a similar table.