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Comparison of Different Learning Preferences in MBBS Students by VARK Model

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Abstract

Background: Understanding students' learning preferences is essential for optimising teaching and learning methods in medical education. This study aimed to assess learning methods among second-year MBBS (2024 batch) students in core subjects across phase. **Materials and Methods:** After obtaining Institutional Ethics Committee approval, a descriptive study was conducted among 109 volunteer students. The study was carried out during the second year of MBBS at ESIC Medical College. Learning preferences were assessed using the Fleming and Mills-based VARK unimodal modified questionnaire (version 8.02), consisting of 33 multiple-choice questions, administered via Google Forms. Responses were collected and analysed using Open EPI software. **Results:** All Student responses were converted into percentages, and p-values were calculated. The distribution of learning preferences in all students are 39.47% for Visual(V), 41.32% for Auditory(A), 35.49 % for Read/write(R) and 5.8% for kinesthetic(K). Statistically significantly higher preferences ($p < 0.05$) were observed for Read/write in Biochemistry, Visual in Anatomy, and Auditory in Physiology when compared with other learning methods. High achievers (≥75% marks) also preferred predominantly Read/write for Biochemistry, Visual for Anatomy, and Auditory for Physiology. 50.33% of students preferred the kinesthetic method in practical learning. **Conclusion:** The study states that most of the MBBS students preferred Read or Write for Biochemistry, Visual for Anatomy, Auditory for Physiology and kinesthetic for all practical. This knowledge will be helpful for enhancing the comprehensive development of effective planning in teaching and learning methods.

Keywords
VARK, learning preference, academic performance.

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INTRODUCTION:

BACKGROUND

University students come from a wide range of socio-economic backgrounds, vary in age, and bring diverse cultural experiences, previous education, levels of preparedness, competencies, and their choice of methods of learning and learning preferences to the classroom. This diversity makes effective teaching particularly demanding. While *teaching* refers to the act of delivering information, *learning* is more complex and depends on individual student characteristics. The fact that students differ in their preferences for various modalities of learning is a fact unlikely to surprise any teacher[2, 3]. Several

factors contribute to how well students learn. These include their interest and motivation in the subject, level of skill and mastery, active participation in the learning process, emotional and psychological states (such as curiosity, confidence, boredom, and motivation), and the learning strategies they choose to use[4]. Learning style inventories are tools designed to identify how students typically approach, process, and understand new information. One widely used model is the VARK framework developed by Neil Fleming, which classifies learners based on the sensory channels they prefer when taking in information. According to the VARK model, visual learners (V) benefit from diagrams, flowcharts, graphs, and other image-based materials. Aural learners (A) prefer hearing information—through lectures, discussions, or recorded material—and may retain content better when listening. Read/write learners (R) engage most effectively with text, such as notes and handouts. Kinesthetic learners (K) learn best through hands-on practice, real-world examples, or physical interaction rather than passive listening. In his critical commentary *"I'm different; not dumb: Modes of presentation (V.A.R.K.) in the tertiary classroom* [5] Fleming explains that students use various methods to transform educational input into lasting knowledge. Being aware of these different learning preferences enables educators to better recognize and address students' learning challenges. Diversity in students' socio-economic, cultural, and educational backgrounds leads to varied learning preferences and needs, making teaching more complex and necessitating learner-centered approaches such as the VARK model proposed by Neil Fleming to enhance effective learning. Consequently, competency based undergraduate curriculum for the Indian medical graduates emphasizes outcome-based, integrated, and student-centric curricula aligned with global competencies to accommodate these differences and improve learning outcomes[6].

OBJECTIVES

1. To identify VARK preferences among medical students in biochemistry, anatomy and physiology.
2. To compare statistically significant association between learning preference and academic performance.

MATERIALS AND METHODS

Study design: The present study design is a descriptive study.

Study setting: The study was conducted at **ESIC Medical College**, among undergraduate MBBS students in the academic setting during scheduled class hours.

Study period: August 2025 – February 2026

Sample size: The total sample size of the study consisted of **109 student volunteers**.

Study participants: The study participants included **second-year MBBS students who had recently completed their first year of MBBS** at ESIC Medical College.

Inclusion criteria:

Students who met the following criteria were included in the study:

- Second-year MBBS students who had recently completed first-year MBBS
- Students willing to participate voluntarily
- Students who provided informed consent
- Students who responded to the questionnaire via Google Forms

Exclusion criteria

Students who met any of the following criteria were excluded:

- Students who were absent during data collection
- Students who submitted incomplete questionnaire responses

Validity of Questionnaire

The study used the Fleming and Mills-based VARK modified unimodal questionnaire (Version 8.02)[7]consisting of 33 multiple-choice questions 11 questions each in: Biochemistry, Anatomy Physiology Includes both theory and practical questions after thorough review from medical education experts. The VARK questionnaire is a widely used and validated tool for assessing learning style preferences (Visual, Aural, Read/Write, and Kinesthetic). Previous studies have demonstrated adequate validity and reliability of the VARK questionnaire for measuring learning preferences.

RESULTS

All Student responses are converted into percentages, and p-values are calculated using MedCalc software. Distribution of highest learning preferences ($p < 0.05$) observed that 35.49% Read/write in Biochemistry. 39.47% Visual in Anatomy, 41.32% Auditory in Physiology. High achievers (≥75% marks) learning preference is 47.13% Read/write in Biochemistry, 38.81% Visual in Anatomy, 43% Auditory in Physiology.55% in Biochemistry, 49% in Anatomy, 47% in Physiology preferred the kinesthetic method for learning practical experiences.

In the VARK model, students with a Visual (V) preference learn most effectively through *visual representations* such as diagrams, flowcharts, charts,

and spatial displays, which help them organize and recall complex information. In this study, a moderately high Visual preference in Biochemistry suggests reliance on pathway maps and biochemical charts to internalize intricate concepts, while an even higher visual score in Anatomy reflects the importance of anatomical diagrams and structural illustrations for understanding form and relationships. A strong Visual preference for Physiology indicates that flowcharts and graphical representations of physiological mechanisms also facilitate learning in that discipline. The Auditory (A) modality denotes a preference for information that is *heard or spoken*, including lectures and discussions. A low auditory percentage for Biochemistry indicates that listening alone is less relied upon for conceptual understanding, whereas a relatively high auditory score in Anatomy suggests that verbal explanations and interactive dialogue enhance grasping structural detail; a moderate auditory preference in Physiology shows that although verbal explanations are valuable, they are less dominant compared to visual methods. Read/Write(R) learners favor *textual information* such as textbooks, lecture notes, and written explanations, and very high read/write scores across Biochemistry, Anatomy, and Physiology reflect students' strong reliance on reading and writing to memories terminology and process conceptual material. Finally, the Kinesthetic (K) preference emphasizes *hands-on experience and practice*. A low to moderate kinesthetic percentage in Biochemistry and Anatomy suggests that laboratory or practical activities are not the dominant learning mode for most students in these subjects, whereas a comparatively higher kinesthetic score in Physiology indicates that simulations, practical exercises, and active engagement are more appreciated as learning tools in that domain. Together, these modality distributions illustrate how medical students favor different sensory modes of learning across core subjects, emphasizing the need for multimodal instructional strategies in medical education.

In the high-achieving subgroup (students scoring > 75%), the Visual (V) modality reflects a preference for learning through *diagrams, charts, labeled illustrations, and structured imagery*, with Anatomy showing the highest visual preference, followed by Physiology and Biochemistry, indicating that visual representations are particularly helpful for mastering complex anatomical structures and physiological processes. The Auditory (A) modality, which relates to *learning through listening, lectures, and verbal explanation*, is moderately represented across subjects, with Biochemistry and Physiology showing stronger auditory percentages than Anatomy, suggesting that oral explanations and discussions are beneficial for consolidating theoretical concepts in these areas. The Read/Write (R) modality, associated with *text-based information, reading, and written notes*, is the dominant preference across all three subjects, and especially in Biochemistry, indicating that top-scoring students rely heavily on written materials and textbook-based study strategies to achieve high performance. In contrast, the Kinesthetic (K) modality, which involves *learning through hands-on experience, practical exercises, and simulation*, is generally low among high achievers in Biochemistry and Physiology but somewhat more prominent in Anatomy, reflecting that experiential activities such as dissection or model use can support learning but are not the primary strategy among students scoring highest on theory. Together, these patterns highlight how students with strong academic performance tend to integrate multiple sensory modalities, with text- and image-based strategies being the most heavily used across core pre-clinical subjects.

In evaluating practical learning preferences among MBBS students, the Visual (V) modality characterized by learning through *diagrams, models, and visual aids* is moderately represented, with Anatomy showing the highest visual preference, followed by Physiology and Biochemistry, indicating that visual tools support practical understanding but are not dominant. The Auditory (A) preference, associated with *learning through listening and verbal instruction*, shows a similar trend of moderate representation, with Physiology highest, then Anatomy and Biochemistry, suggesting that spoken explanations and verbal clarification contribute to practical learning but are less preferred than other modalities. The Read/Write (R) modality, reflecting a preference for *text and written information*, has lower percentages across all subjects, indicating that text-oriented strategies are less relied upon in practical contexts compared to theory. In contrast, the Kinesthetic (K) modality defined by *hands-on experience, doing, and real-world practice*—is the most strongly preferred mode in practical settings, with Biochemistry, Anatomy, and Physiology all showing high kinesthetic percentages, especially in Biochemistry. This pattern implies that practical and experiential activities such as lab work, simulations, and direct manipulation of materials are highly valued by students during practical sessions, highlighting the importance of incorporating active, hands-on learning experiences in medical practical education. The results align with the fundamental VARK framework, which emphasizes that learners

engage differently with information through sensory modalities, and show that kinesthetic strategies are especially prominent in practical learning environments.

Table 1: Learning preference percentages in theory of all MBBS students in VARK model

SUBJECT	Visual	Auditory	Read / Write	KINESTHETIC
Biochemistry	16.14%	33.9%	35.49%	14.47%
Anatomy	39.47%	13.92%	32.19%	14.42%
Physiology	18.59%	41.32%	34.03%	6.06%

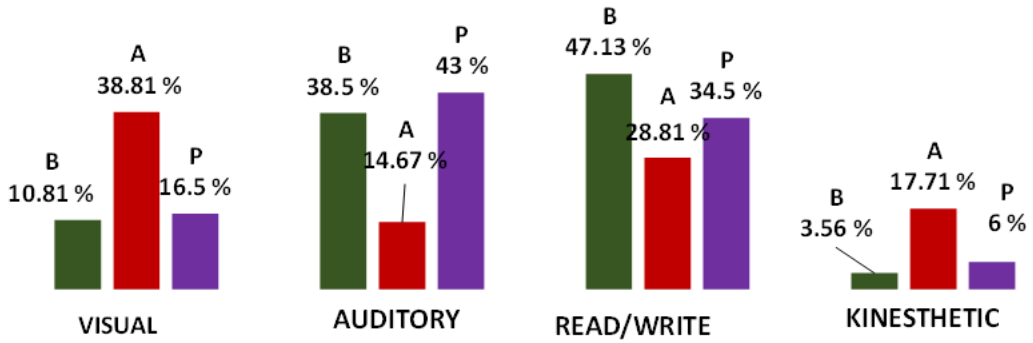

Figure 1: Learning preference percentages in theory of MBBS students scored >75% in VARK model

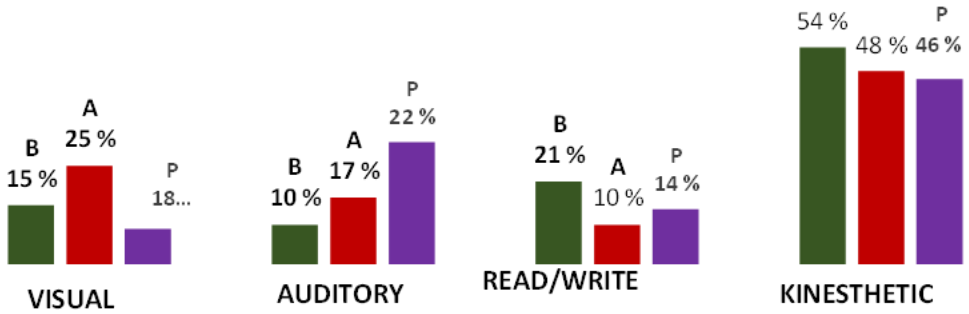

Figure 2: practical preference percentages of all MBBS students in VARK model

DISCUSSION

Learning preferences among medical students vary according to the sensory modalities through which information is received and processed. The VARK model categorizes learning into four primary modalities: Visual (V), Auditory (A), Read/Write (R), and Kinesthetic (K), representing different ways in which learners perceive and retain information[7]. Visual learners prefer diagrams, charts, and graphical representations; auditory learners benefit from listening and verbal explanations; read/write learners rely on textual materials; and kinesthetic learners learn best through hands-on experiences and practical activities. Understanding these preferences is particularly important in medical education, where subjects such as Biochemistry, Anatomy, and Physiology require integration of theoretical knowledge with practical skills[8]. Studies suggest that students often demonstrate varying modality preferences across subjects and learning contexts, highlighting the importance of incorporating multimodal teaching strategies to enhance comprehension and academic performance.

In the present study, learning modality patterns varied across subjects, highlighting the importance of subject-specific and multimodal instructional strategies. In Biochemistry (theory), Read/Write preference was predominant, followed by Visual modality, indicating that students relied heavily on textbooks, structured notes, and written explanations to understand biochemical pathways and reactions, while diagrams such as metabolic charts further supported conceptual understanding. Auditory preference was comparatively low, suggesting that listening alone was less effective for mastering abstract biochemical concepts, and Kinesthetic preference was moderate, indicating that although laboratory activities were useful, they were not the primary method of learning theoretical content.

In Anatomy (theory), Visual preference was highly prominent, reflecting the critical role of diagrams, labelled illustrations, and structural representations in understanding spatial relationships and anatomical details. Read/Write preference also remained high, demonstrating the importance of reading descriptive content alongside visual aids. Auditory preference showed moderate representation, suggesting that verbal explanations during demonstrations supported learning, while Kinesthetic preference remained moderate, indicating that although practical exposure enhances comprehension, theoretical understanding was still largely dependent on visual and textual materials. This finding aligns with previous studies indicating that anatomy learning commonly integrates visual and kinesthetic approaches due to the structural nature of the subject.

In Physiology (theory), both Visual and Read/Write preferences were strongly represented, suggesting that students benefited from flowcharts, graphs, and written explanations to understand physiological mechanisms and functional relationships. Auditory preference was moderate, indicating that lectures and discussions contributed to reinforcing concepts but were not the dominant learning mode. Kinesthetic preference was relatively higher compared to other theory subjects, suggesting that simulation-based explanations and activity-oriented learning enhanced comprehension of dynamic physiological processes.

In practical learning across subjects, modality preferences demonstrated a distinct shift toward Kinesthetic learning, emphasizing the importance of hands-on experience, laboratory work, simulations, and practical demonstrations. Biochemistry practicals showed strong kinesthetic preference due to reliance on experimental procedures and manipulation of laboratory materials. Anatomy practicals also reflected high kinesthetic involvement, particularly through model-based learning and dissection-related activities that help students visualize structures in three-dimensional form. Physiology practicals demonstrated similar kinesthetic dominance, as performing experiments and observing physiological responses supported deeper understanding of functional mechanisms. Studies have shown that kinesthetic and multimodal approaches are commonly preferred among medical students during practical learning due to the experiential nature of skill-based education.

Overall, these subject-wise patterns demonstrate that theoretical subjects predominantly favour Visual and Read/Write modalities, whereas practical sessions strongly favour Kinesthetic learning. These findings highlight the necessity of adopting multimodal teaching strategies, including diagrams, structured textual materials, verbal discussions, and experiential learning activities, to effectively address diverse learning needs and enhance academic performance among medical students. Such multimodal approaches are widely recommended in medical education to accommodate varying learning preferences and improve educational outcomes.

The findings of the present study are in agreement with the study conducted by Bikash Chandra Satapathy et al., which reported that unimodal learning preferences were more prevalent among MBBS students, with nearly 70% of students showing preference for a single dominant sensory modality. Similarly, the present study also demonstrated the presence of dominant modality preferences, although these preferences varied according to subject. In the current study, Read/Write preference predominated in Biochemistry, Visual preference in Anatomy, and Auditory preference in Physiology, indicating that students relied on specific sensory modalities depending on the nature of the subject. This observation supports the findings of Satapathy et al., where students predominantly relied on a single modality, emphasizing that learners often favor one dominant learning style rather than using all modalities equally. Thus, both studies highlight that learning preferences among medical students are not uniform, and that subject characteristics influence the choice of dominant learning modality. These similarities reinforce the importance of adopting flexible and multimodal teaching strategies tailored to student learning preferences to enhance academic understanding and performance.[9]

The findings of the present study are comparable with those reported by Nagaswami S. Vasan et al., who highlighted the importance of kinesthetic learning approaches in anatomy education, particularly through active methods such as clay modelling, drawing, and hands-on manipulation to enhance three-dimensional understanding of anatomical structures. Their study demonstrated that kinesthetic learners benefit from constructing physical models, which helps develop stronger visuospatial understanding and improves retention of anatomical relationships. Similarly, the present study observed a high kinesthetic preference in anatomy practical sessions, indicating that students value hands-on activities such as model handling, dissections, and practical demonstrations for better comprehension of anatomical structures[10].

This similarity supports the role of active, experiential learning as an essential component of anatomy education. However, a notable difference

between the two studies is that while Vasan et al. primarily focused on specific kinesthetic techniques such as clay modelling and creative model construction, the present study assessed overall learning modality preferences across multiple subjects, including Biochemistry and Physiology, rather than focusing exclusively on anatomy learning methods. Overall, both studies emphasize the importance of kinesthetic and practical learning strategies in anatomy, while the present study further expands this concept by demonstrating how learning preferences vary across subjects and learning contexts, thereby reinforcing the need for subject-specific and multimodal teaching approaches in medical education.[11]

DISCUSSION

The findings of this study indicate that among MBBS students, subject-specific learning preferences vary across sensory modalities, with a predominant inclination toward Read/Write strategies for Biochemistry, Visual strategies for Anatomy, Auditory strategies for Physiology, and a strong Kinesthetic preference across all practical sessions. These distinct patterns reflect how students engage with different types of content: text-based information supports learning in Biochemistry, visual representations aid in structural comprehension in Anatomy, verbal explanations and discussions facilitate understanding in Physiology, and active, hands-on experiences are highly valued in practical contexts. Similar research in medical education has reported diverse and multimodal learning pattern distributions, with kinesthetic modalities frequently emerging as a dominant preference, and emphasizes the importance of aligning instruction with learner preferences to enhance engagement and educational effectiveness. These insights underscore the need for teaching strategies that integrate multiple instructional methods [12] including practical demonstrations, visual aids, interactive discussions, and comprehensive textual resources, to create a learner-centered educational environment that accommodates the varied sensory preferences of medical students and optimizes learning outcomes.

Recommendations:

1. Adopt multimodal teaching strategies
2. Strengthen subject-specific teaching methods
3. Enhance practical (kinesthetic) learning
4. Encourage active learning methods.
5. Integrate VARK-based awareness among students
6. Faculty training programs.
7. Further research

Limitation:

1. Small sample size
2. Single-center study
3. Cross-sectional design
4. Limited scope of variables

Declaration:

Conflict of Interest:

There are **no conflicts of interest** related to this study.

Funding:

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Role of Funding Agency:

Not applicable.

Ethical Approval:

The study was conducted after obtaining informed consent from participants and approval from the institutional ethics committee.

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