

PREFERRED LEARNING STYLES AND STRATEGIES AMONG MEDICAL STUDENTS IN PAKISTAN: A CROSS-SECTIONAL STUDY USING THE VISUAL, AUDITORY, AND KINESTHETIC (VAK) MODEL

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ABSTRACT

This study aimed to analyze and evaluate the preferred learning styles and strategies among medical students. A cross-sectional, descriptive study was conducted using random sampling. The research took place at the Department of Psychology and Behavioral Sciences, Quetta Institute of Medical Sciences (QIMS), from February 2023 to August 2023. A total of 254 medical students participated, including 122 males and 132 females. Demographic data and learning style preferences were assessed using the VAK (Visual, Auditory, Kinesthetic) learning style model. Students also ranked learning strategies such as lectures, tutorials, demonstrations, and practical's based on their preference. The questionnaire, in English, was administered to large groups in two sittings. The distribution of learning styles was as follows: visual (36%), auditory (24%), and kinesthetic (40%). Among the students, 69% preferred multimodal learning (VAK), with 41% using trimodal, 20% bimodal, and 39% unimodal approaches. Practical sessions were the most preferred learning strategy (42%), while tutorials were the least preferred (15%). A significant gender difference was observed, with females favoring auditory modalities and males preferring kinesthetic modalities (p -value < 0.05). Male students predominantly preferred kinesthetic and visual learning styles, while females leaned towards auditory and kinesthetic modalities. Most students exhibited a multimodal learning preference. Recognizing and addressing learning style preferences in educational institutions can enhance students' learning experiences and outcomes, facilitating better academic performance.

Keywords: *Learning modalities, auditory, kinesthetic, visual, learning strategies, medical students*

INTRODUCTION

Learning styles refer to an individual's consistent approach to gathering, interpreting, processing, understanding, organizing, analyzing, and retaining information. In education, learning styles highlight the systematic differences in how individuals typically acquire and apply information in learning contexts (AlQahtani et al., 2018). The concept has gained significant attention in educational research, emphasizing its role in enhancing students' academic success (Bennadi et al., 2015). Understanding and addressing learning styles help educators tailor their teaching strategies, enabling students to become

more competent and effective learners (Al-Saud, 2013). Research suggests that evaluating and adapting to students' learning styles can significantly improve their performance and motivation (Baykan & Nacar, 2007). This practice not only enhances academic achievements but also fosters professional growth, enabling students to excel in their chosen fields (Carbo, 1983). Conversely, neglecting learning styles can result in missed opportunities to nurture potential talent. Students whose learning needs are overlooked may exhibit poor academic performance, diminished classroom engagement, irregular

attendance, and, in severe cases, dropout tendencies (Cuyamaca College, 2008). To address these challenges, educators must embrace diverse instructional approaches to cater to varying learning styles. This creates a balanced learning environment where students are taught in ways that align with their preferences, fostering enthusiasm and improved learning outcomes. Such adaptations also enable teachers to identify and resolve previously unaddressed student challenges, ultimately enhancing comprehension and retention (Felder & Brent, 2010). Moreover, tailoring learning strategies to individual preferences significantly enhances students' communication and self-expression abilities. For example, integrating learning styles into teaching methods can improve public speaking skills and facilitate more effective interpersonal communication (Gadbury-Amyot et al., 2017).

VAK: The Visual, Auditory, and Kinesthetic (VAK) model categorizes learners based on their sensory preferences (Cuyamaca, 2008). Visual learners rely on images, charts, and diagrams to grasp information. Auditory learners thrive on verbal instructions, discussions, and auditory stimuli. Kinesthetic learners prefer hands-on activities and physical engagement with materials. This framework, rooted in neuro-linguistic programming, helps educators understand how sensory preferences influence learning, guiding them to adapt teaching methods that align with students' innate tendencies (Gadbury-Amyot et al., 2017).

Significance of VAK and Learning Style: The VAK model underscores how sensory preferences shape the way students absorb and process information. Research indicates that more than 70% of school-aged children exhibit strong perceptual preferences, which significantly influence their academic success (James & Gardner, 1995). Educators must acknowledge these differences and modify teaching approaches to address diverse learning needs effectively. This adaptability ensures that students receive information in a manner that aligns with their natural inclinations, fostering a more inclusive and effective learning environment (Felder & Brent, 2010). Failing to consider learning styles can create significant barriers in the educational process. For instance, when there is a mismatch between a student's preferred learning style and the teacher's instructional methods, students may experience difficulty understanding the curriculum. This misalignment often leads to frustration, lower

academic achievement, and disengagement (Baykan & Nacar, 2007). Teachers may also misinterpret these struggles as a lack of effort or ability, resulting in undue criticism and strained teacher-student relationships. On the other hand, acknowledging and integrating learning styles into teaching methods has numerous benefits. It not only improves comprehension and retention but also equips students with the skills to articulate their thoughts and ideas effectively. This adaptability promotes a more dynamic and engaging classroom environment, where students feel empowered to participate and excel (Gadbury-Amyot et al., 2017).

In the Pakistani educational context, the emphasis on traditional, lecture-based teaching often overlooks the diverse learning preferences of students. Many classrooms are not equipped to accommodate kinesthetic learners who benefit from hands-on activities or visual learners who prefer diagrams and illustrations. This lack of flexibility can exacerbate the challenges faced by students, particularly in overcrowded classrooms where individualized attention is limited. Failing to consider learning styles can create significant barriers in the educational process. For instance, when there is a mismatch between a student's preferred learning style and the teacher's instructional methods, students may experience difficulty understanding the curriculum. This misalignment often leads to frustration, lower academic achievement, and disengagement (Baykan & Nacar, 2007). Teachers may also misinterpret these struggles as a lack of effort or ability, resulting in undue criticism and strained teacher-student relationships. Incorporating VAK-based approaches into Pakistan's teaching methodologies can bridge these gaps. Acknowledging and integrating learning styles into teaching methods not only improves comprehension and retention but also equips students with the skills to articulate their thoughts and ideas effectively. This adaptability promotes a more dynamic and engaging classroom environment, where students feel empowered to participate and excel (Gadbury-Amyot et al., 2017). Additionally, it provides an opportunity to train teachers in recognizing and accommodating diverse learning styles, ensuring that education is inclusive and accessible to all.

Research Context and Gaps: Studies have explored learning styles extensively, focusing on how students' preferences influence their academic success. However, limited research has been

conducted to evaluate the correlation between preferred learning styles and teaching strategies in medical education, particularly in Pakistan (Al-Saud, 2013). Medical students often face rigorous academic demands that require tailored teaching approaches to optimize learning outcomes. Understanding the interplay between learning styles and instructional methods can help educators develop effective strategies to enhance students' learning experiences. This study aims to address this gap by assessing medical students' preferred learning styles and strategies. By doing so, it seeks to provide insights into how these preferences can be integrated into teaching methodologies to improve academic performance and overall learning satisfaction. The findings will contribute to a better understanding of how personalized teaching approaches can foster a more effective and inclusive learning environment in medical education. Learning styles play a crucial role in shaping students' educational experiences and outcomes. The VAK model provides a practical framework for understanding sensory preferences and their impact on learning. Educators who adapt their teaching methods to accommodate diverse learning styles can significantly enhance students' academic performance, motivation, and communication skills. While research has highlighted the importance of learning styles in education, further exploration is needed to understand their application in medical education. This study seeks to fill this gap by examining the relationship between learning styles and teaching strategies, offering valuable insights for educators and policymakers.

Methodology

This cross-sectional study was conducted among medical students registered at Quetta Institute of Medical Sciences (QIMS), Quetta, Pakistan. A total of 254 students voluntarily participated in the research, comprising 122 males and 132 females. The study took place from February 2023 to August 2023 at the Department of Behavioral Sciences and Psychology, QIMS. The methodology was designed to identify the preferred learning styles and teaching strategies among medical students using standardized tools and statistical analyses. The study utilized a random sampling method to ensure a representative selection of participants. Students from different academic years were included,

enhancing the generalizability of findings across the medical education continuum.

Three distinct questionnaires were employed to gather data:

1. Demographic and Teaching Modalities Questionnaire:

This questionnaire gathered personal and demographic data, including name, age, gender, and birth order. It also assessed preferences for teaching-learning strategies such as lectures, tutorials, practical sessions, and self-study.

2. Learning Styles Questionnaire (VAK Model):

A 20-item questionnaire based on the Visual, Auditory, and Kinesthetic (VAK) model was used to identify participants' preferred learning styles. The VAK model was chosen for its simplicity, reliability, adaptability, and ability to align with study plans and teaching strategies. Each item offered three options, corresponding to the three learning modalities (visual, auditory, and kinesthetic). Students were allowed to select more than one option if applicable, enabling an assessment of multimodal preferences.

3. Semi structured questionnaire:

A 6-item semi-structured questionnaire was also administered to gather qualitative insights into students' preferences and challenges with learning styles and teaching strategies. The items included:

1 Can you describe your most effective way of learning new material? What makes this approach work best for you (e.g., visual aids, listening to lectures, hands-on activities)?

2 When preparing for exams, what study strategies do you typically use? Are there any specific tools or resources (e.g., flashcards, group discussions, online videos) that you find particularly helpful?

3 Do you prefer learning in a group setting or studying independently? How does this preference impact your ability to understand and retain information?

4 How do you incorporate feedback from instructors or peers into your learning process? Can you give an example of a time when feedback significantly improved your understanding of a topic?

5 What role does technology (e.g., e-learning platforms, apps, recorded lectures) play in your learning?

Are there specific digital tools or platforms you rely on for better comprehension and retention?

6 If you could make changes to the way you are taught in medical school, what would they be?

How do you think these changes would enhance your learning experience?

The questionnaires, were in English, were administered in large group settings in multiple sessions to accommodate the schedules of the participants. Prior to distribution, the aim and purpose of the study were clearly explained to the students. Participants spent approximately 30 minutes completing the questionnaires. Responses were scored following standardized guidelines available for the VAK model. Modal preferences were determined by analyzing the scores for visual, auditory, and kinesthetic categories. Multimodal preferences (e.g., trimodal or bimodal) were also identified where applicable. Descriptive statistics, including frequencies and percentages, were used to analyze demographic data and identify preferred learning styles and teaching modalities. The independent samples **t-test** was applied to compare VAK scores between male and female students. Additionally, Pearson's correlation coefficient was

employed to examine the relationship between learning styles and teaching strategies.

Ethical Considerations: Approval for the study was obtained from the Ethics Review Committee (ERC) of QIMS. Informed written consent was obtained from all participants after explaining the study's objectives, procedures, and voluntary nature. Students were assured that their responses and personal information would remain confidential.

Results

Figure 1 illustrates the distribution of the three primary learning styles among students based on the VAK model, which categorizes learners according to their preferred method of observing and acquiring information. The findings revealed that the majority of respondents, 104 students (40.1%), identified as kinesthetic learners, indicating a preference for learning through hands-on experiences and physical activities. Meanwhile, 90 students (36.3%) preferred the visual learning style, relying on images, diagrams, and visual aids for understanding. The remaining 60 students (23.6%) were categorized as auditory learners, favoring listening and verbal communication as their primary means of learning.

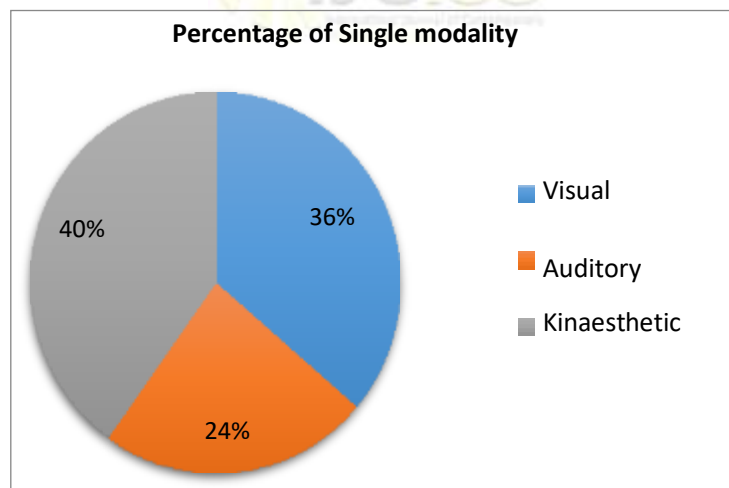


Figure 1 Percentage of Single modality

Figure 2 presents the distribution of students based on their preferred combination of learning styles. It shows that 41% of the participants adopted a trimodal learning style, utilizing a blend of visual, auditory, and kinesthetic approaches. Another 39%

of the students favored a bimodal learning style, integrating two of the three modalities. In contrast, 20% of the students exhibited a unimodal learning style, relying solely on one dominant mode of learning.

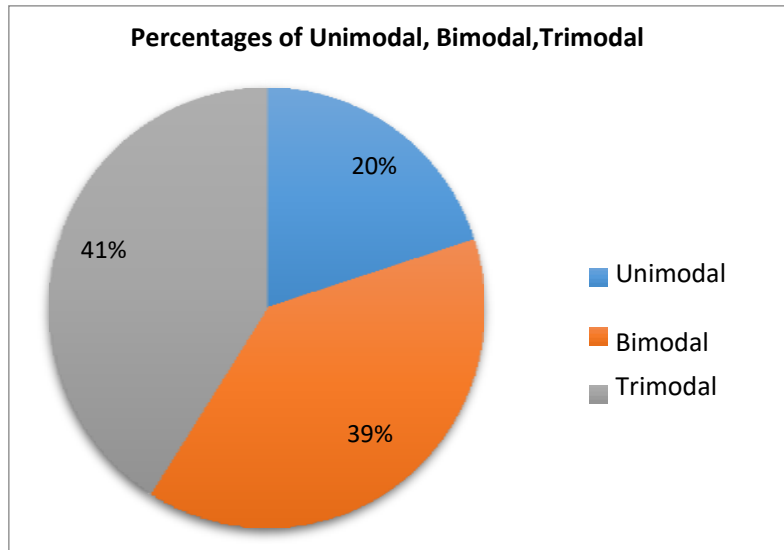


Figure 2 Percentages of Unimodal, Bimodal, Trimodal

Figure 3 highlights the preferred learning strategies among the respondents. The analysis revealed that the most frequently chosen strategy was practical activities, selected by 42% of the students. These learners prioritized experiential and hands-on learning methods, aligning with the kinesthetic learning style. The second most preferred strategy was lectures, favored by 34% of the students,

reflecting the auditory and visual preferences of a significant portion of the group. Self-study was chosen by 15% of the respondents, indicating a preference for independent learning and reflection. Finally, tutorials emerged as the least preferred strategy, with only 9% of students indicating this as their primary choice.

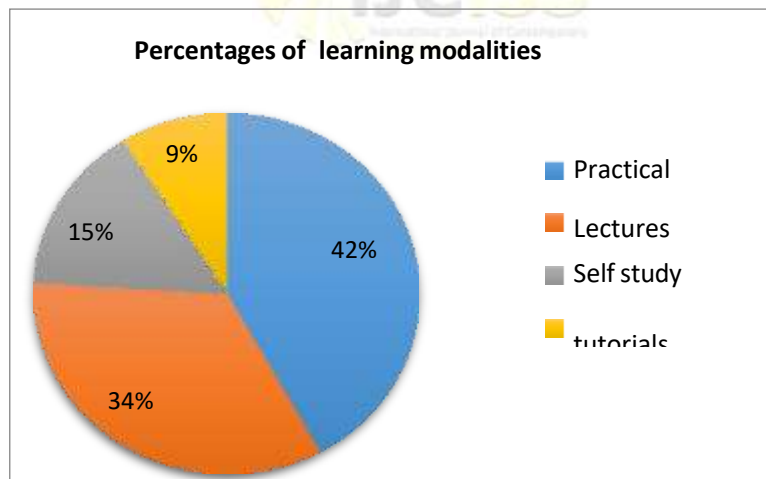


Figure 3 Percentages of learning modalities

Overall, the results underscore the diverse learning preferences among students, with a notable inclination toward practical, hands-on methods and multimodal learning approaches. These findings suggest the importance of incorporating varied teaching strategies to cater to the distinct needs of different learners, enhancing engagement and academic performance.

- 1. Demographic and Teaching Modalities Questionnaire:** This questionnaire gathered personal and demographic data, including name, age, gender, and birth order. It also assessed preferences for teaching-learning strategies such as lectures, tutorials, practical sessions, and self-study.
- 2. Learning Styles Questionnaire (VAK Model):** A 20-item questionnaire based on the Visual,

Auditory, and Kinesthetic (VAK) model was used to identify participants' preferred learning styles. The VAK model was chosen for its simplicity, reliability, adaptability, and ability to align with study plans and teaching strategies. Each item offered three options, corresponding to the three learning modalities (visual, auditory, and kinesthetic). Students were allowed to select 4.

more than one option if applicable, enabling an assessment of multimodal preferences.

3. Semi structured questionnaire:

A 6-item semi-structured questionnaire was also administered to gather qualitative insights into students' preferences and challenges with learning styles and teaching strategies. Items The items included:

Table 1: Reliability analysis

Sr.	Scales	Cronbach's Alpha	No of items
1	Learning Styles Questionnaire (VAK Model)	0.92	20
2.	Semi structured questionnaire	0.91	6
3.	Preferred mode of teaching-learning method	0.90	8

The reliability analysis evaluates the internal consistency of the two instruments used in the study: The Learning Styles Questionnaire (VAK Model) and the semi-structured questionnaire. The results reveal excellent reliability for both tools, as indicated by their high Cronbach's Alpha values. The Learning Styles Questionnaire, consisting of 20 items, achieved a Cronbach's Alpha of **0.92**, demonstrating that the items within the questionnaire are highly consistent in measuring the visual, auditory, and kinesthetic learning styles of respondents. Similarly, the semi-structured questionnaire, with 6 items, obtained a Cronbach's Alpha of **0.91**, indicating strong internal consistency in assessing the respondents' learning preferences and strategies. These high reliability scores suggest that both instruments are cohesive and dependable for accurately capturing the constructs they are designed to measure. Consequently, the results derived from these tools can be considered robust and credible for further analysis.

Comparison of Preferred VAK Modalities Between Male and Female Respondents

Table 2 provides a detailed comparison of the preferred Visual, Auditory, and Kinesthetic (VAK) learning modalities between male and female

students, using the mean scores and standard deviations (SD) for each modality. The table highlights statistically significant differences between genders in their learning preferences, as determined by the p-values from t-tests. The data indicates that a significantly higher number of female respondents preferred the auditory learning modality compared to males, although this difference did not reach statistical significance (**p = 0.13**). For the visual learning modality, females also scored higher, with a mean \pm SD of **5.63 \pm 2.23**, compared to males, who scored **4.73 \pm 2.19**. This difference was statistically significant (**p = 0.03**), suggesting a greater inclination among female students toward visual learning strategies. Conversely, the kinesthetic learning modality was significantly more preferred by male students. The mean \pm SD for males in this modality was **7.32 \pm 2.01**, compared to **5.78 \pm 2.12** for females. This difference was highly significant, with a p-value of **0.002**, indicating a strong gender-based variation favoring males in kinesthetic learning.

Table 2: Mean & SD of Male and Female students on Visual, Auditory & kinesthetic (*p-value < 0.05, t-test)

VAK Modality	Gender	Mean ± SD	p-value
Visual	Male	4.73 ± 2.19	0.03*
	Female	5.63 ± 2.23	
Auditory	Male	4.56 ± 1.61	0.13
	Female	5.13 ± 1.41	
Kinesthetic	Male	7.32 ± 2.01	0.002*
	Female	5.78 ± 2.12	

This table demonstrates distinct gender-based preferences in learning modalities. Female students showed a stronger preference for visual and auditory learning, with statistical significance observed in the visual domain. On the other hand, male students exhibited a notably higher preference for kinesthetic learning, with a highly significant difference. These findings suggest the importance of tailoring educational approaches to accommodate gender-

specific learning styles to optimize learning outcomes.

Figure 4 shows the most preferred learning modality of female respondents were lecture (47%) and practical (45%), whereas the male respondents preferred learning modality was practical (41%) and self-study (32%), most preferred learning strategy was practical in both genders

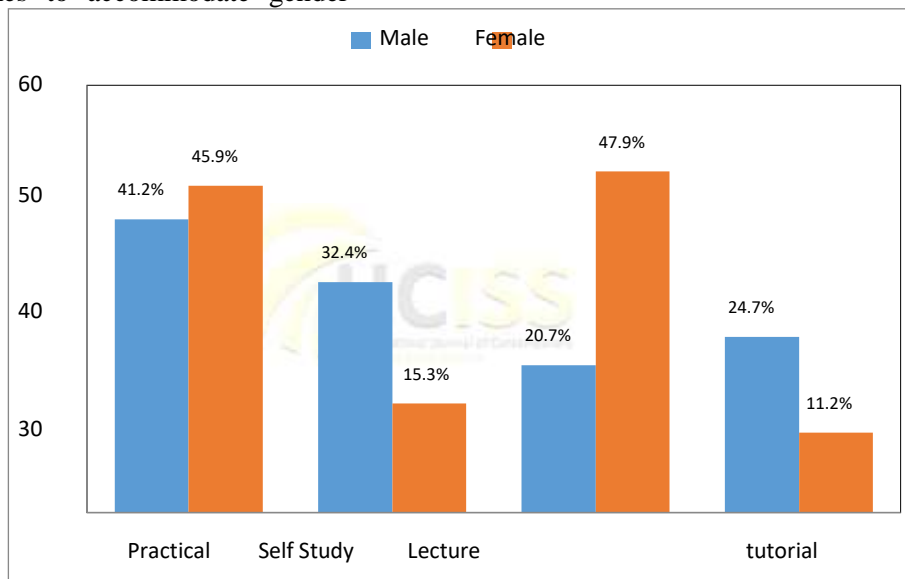


Figure 4 Learning modality

Table 3: Correlation among students' liking for VAK and learning strategies.

Preferred mode of teaching-learning method	Practical	Lectures	Tutorials	Self-Studymethod
Percentage of Student	42	34	9	15
VAK modal	Kinesthetic	Visual	Auditory	
Mean score	15.49	11.69	10.79	6.15

Table 3 presents the correlation between students' preferences for VAK modalities and their chosen learning strategies. The findings indicate that the kinesthetic modality was the most preferred learning style, while practical activities emerged as the most favored learning strategy. A strong positive

correlation was identified between the preferred Visual, Auditory, and Kinesthetic (VAK) modalities and learning strategies, with a Pearson's correlation coefficient of $r = 0.722$. This suggests that students' preferred learning modalities significantly align with their chosen learning approaches.

Table 4: Responses of Learning Styles to Six-Item Semi-Structured Questionnaire

Questionnaire Item	Visual Learners n 254(74, 29.1%)	Kinesthetic Learners n 254(140, 55.1%)	Auditory Learners n 254(40, 15.7%)
1. Effective way of learning new material	Prefer diagrams, charts, and videos	Hands-on activities, practice tasks	Lectures, discussions, audio recordings
2. Study strategies for exams	Use flashcards, color-coded notes	Role-playing, group study, real-life tasks	Listen to recordings, group discussions
3. Preference: Group vs. independent study	Independent with visual aids	Group activities for interactive learning	Group discussions to clarify concepts
4. Incorporating feedback	Annotate notes with feedback details	Practice applying feedback immediately	Listen to feedback and discuss it
5. Role of technology	Rely on videos, apps with visuals	Use simulations, apps with interactive tasks	Use recorded lectures, podcasts
6. Suggested teaching changes	More visual content in lectures	Increase lab-based, hands-on teaching	More interactive discussions

Table 4 presents the responses of Visual, Kinesthetic, and Auditory learners to a six-item semi-structured questionnaire, highlighting their preferred methods of learning, study strategies, and interaction with feedback and technology. Visual learners (29.1% of the sample) generally favored methods involving diagrams, charts, and videos for learning new material. For exams, they preferred flashcards and color-coded notes to aid memorization. When it comes to study preferences, they preferred independent study with visual aids, as this allows them to concentrate on written and visual material. In terms of feedback, visual learners preferred to annotate their notes with feedback details to help solidify learning. For technology, they preferred using videos and apps with visual content to enhance their learning. They suggested that instructors include more visual content in lectures to cater to their learning style. Kinesthetic learners (55.1% of the sample) demonstrated a clear preference for hands-on activities and practice tasks when learning new material. Their exam strategies included role-playing, group study, and real-life tasks, aligning with their need for physical engagement and interaction. They favored group activities for interactive learning, emphasizing the value of experiential learning in collaborative settings. When

receiving feedback, kinesthetic learners tended to practice applying feedback immediately in practical scenarios. In terms of technology, they gravitated towards simulations and apps that provide interactive tasks. They recommended more lab-based, hands-on teaching to better suit their learning style. Auditory learners (15.7% of the sample) preferred lectures, discussions, and audio recordings for learning new material, highlighting their strength in auditory processing. Their study strategies included listening to recordings and participating in group discussions to reinforce concepts. Auditory learners tended to favor group discussions over independent study, as these conversations helped clarify and solidify their understanding. For feedback, they preferred to listen to feedback and engage in discussions about it. Auditory learners favored recorded lectures and podcasts as their primary form of technology, reinforcing their auditory learning preferences. They suggested that teaching methods include more interactive discussions to engage their learning style effectively. The table reveals significant differences in the learning preferences of the three groups. Visual learners prioritize visual content, kinesthetic learners prefer interactive, hands-on approaches, and auditory learners are most engaged through auditory resources and discussions. These insights emphasize the

importance of tailoring teaching strategies to accommodate diverse learning styles for better educational outcomes.

Discussion

Learning preferences significantly influence the effectiveness and enjoyment of the educational experience, contributing to academic success. This study sought to assess the preferred learning styles of medical students across all academic years by utilizing the VAK questionnaire (Visual, Auditory, Kinesthetic). The results indicated that a substantial majority (69%) of the respondents exhibited a multimodal (VAK) learning preference, which suggests that these students prefer to engage with learning materials through multiple modalities to acquire information. These findings are consistent with previous research, which demonstrates that students often learn more effectively when multiple modes of learning are integrated, as this approach supports a variety of learning strategies (Felder & Brent, 2010). Among those who preferred unimodal learning styles, kinesthetic learning emerged as the most favored modality (40%), followed by visual learning (36%) and auditory learning (23%). This distribution reflects the broader trends observed in educational research, where kinesthetic learners, who prefer hands-on engagement with the material, often outperform in environments that emphasize active participation and practical approaches. In contrast, auditory learners, who typically benefit from traditional lecture-based learning, were found in smaller proportions in this study. These findings align with the work of Baykan and Nacar (2007), who observed similar results in their study of first-year medical students in Turkey, where kinesthetic learning was the dominant modality.

Active learning, which promotes critical thinking and cognitive development, is often associated with kinesthetic and visual learning preferences. These active methods encourage students to assess, evaluate, investigate, interpret, and explain information, which helps to build problem-solving, logical thinking, and decision-making skills (Pashler et al., 2008). In contrast, passive learning methods, such as traditional lectures, tend to cater more to auditory learners, who primarily benefit from auditory input (Shenoy et al., 2013). However, the relatively lower percentage of auditory learners in this study suggests that active learning methods may be more universally effective across a wider range of

students, as they provide opportunities for interaction and engagement, crucial for enhancing comprehension and retention.

The present study also explored the relationship between gender and learning preferences, finding significant differences between male and female students. This is consistent with the findings of Sarabi-Asiabar et al. (2014), who reported that males tended to favor kinesthetic learning, while females were more likely to prefer auditory learning. These differences could be attributed to various cultural, cognitive, and social factors that influence how students engage with learning materials. Understanding such variations can help instructors tailor their teaching methods to better suit the diverse needs of their students (Kolb, 1984).

Moreover, this study supports the growing body of literature that emphasizes the importance of matching teaching strategies with students' preferred learning styles. As noted by Walter Burke and Milone (1981), mismatches between teaching approaches and student learning preferences can lead to reduced engagement and hinder the learning process. On the other hand, adapting instructional strategies to align with students' learning styles can foster a more effective learning environment, enhancing students' intellectual and cognitive abilities (AlQahtani et al., 2018).

The preferred learning strategies identified in this study further support the association between learning styles and effective educational techniques. Practical learning activities, such as lab classes, role-playing, and interactive field trips, were highly favored by students, particularly those with kinesthetic preferences. These students benefit from hands-on training, which allows them to experience and engage with the material directly. For kinesthetic learners, short definitions, fill-in-the-blank exercises, and multiple-choice tests are ideal methods of assessment, as they align with their preference for active learning. In contrast, long essays or extensive written exams, which demand more passive forms of engagement, may be less effective for kinesthetic learners (Gadbury-Amyot et al., 2017).

Visual learning strategies, including the use of slides and presentations, were the second most preferred method among participants. This suggests that a significant proportion of students, particularly those with a visual learning style, benefit from seeing information presented in a structured and visual format. Visual learners often retain information

better when they can see diagrams, charts, or videos that illustrate the concepts being discussed. Auditory learning methods, such as lectures, were the least preferred among participants, reinforcing the idea that a multimodal approach to teaching is more effective in accommodating the diverse learning needs of students (Bennadi et al., 2015).

The findings of this study have important implications for medical education, particularly in terms of developing teaching strategies that are more responsive to students' learning preferences. By incorporating active, hands-on learning techniques, instructors can engage students in ways that align with their preferred learning styles, thereby enhancing their cognitive abilities and overall learning outcomes. Moreover, providing training and support for medical instructors to understand and accommodate students' learning preferences can lead to a more personalized and effective teaching environment, ultimately improving student performance and satisfaction (Al-Saud, 2013).

However, there are several limitations to this study. One significant limitation is the relatively small sample size, which was drawn from a single institution. This restricts the generalizability of the findings to all medical students in Pakistan. Future studies should seek to include a larger and more diverse sample of students to better understand the variations in learning preferences across different institutions and regions. Additionally, while the VAK questionnaire provides valuable insights into learning preferences, it does not account for all possible learning styles. Other learning style inventories, such as the VARK (Visual, Auditory, Reading/Writing, Kinesthetic) model, could be used in future research to explore additional modalities and gain a more comprehensive understanding of students' learning preferences (Cuyamaca College, 2008).

Future research could also explore the relationship between learning styles and academic performance, as well as how learning styles evolve over the course of medical education. For example, studies could investigate whether students' learning preferences shift between the pre-clinical and clinical phases of their education and how these changes might influence their performance. Additionally, research could examine the impact of teaching-learning strategies tailored to specific learning styles on students' cognitive development and performance in clinical settings. Finally, investigating the

relationship between personality traits, learning styles, and student satisfaction could provide valuable insights into how individualized learning approaches can enhance the overall student experience (Felder & Brent, 2010).

Conclusion

The recognition and understanding of students' learning preferences are crucial for both medical educators and students. By identifying and addressing students' preferred learning styles, educators can design more effective teaching strategies that cater to the diverse needs of their students. This personalized approach not only enhances students' engagement and learning outcomes but also fosters a more inclusive and supportive learning environment. Medical students who are aware of their learning preferences can develop self-directed learning habits, which allow them to better process and retain information, ultimately leading to improved academic performance. Instructors who are mindful of students' learning styles can adapt their teaching methods to create a more dynamic and effective learning environment, contributing to the success of students in their medical careers.

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