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# Learning styles and their relationship with preferred teaching methodologies and academic achievement among medical students in teaching medical college, Tamil Nadu

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## Abstract:

**BACKGROUND:** Learning styles for medical students have been studied worldwide, and instructors must know and employ the best methods to help students learn. This study evaluates undergraduate medical students' learning styles, preferred teaching methods, and academic examination scores.

**MATERIALS AND METHODS:** From January to December 2022, this cross-sectional study was performed with medical students at a teaching hospital in Perambalur, Tamil Nadu, India. About 421 individuals were selected using a probability-proportionate size sampling method. A semi-structured pro forma was used to collect the socio-demographic profile, VARK model learning style questionnaire, and teaching method preferences. The data were analyzed using SPSS-21, and the categorical data were represented as frequency and percentage, whereas mean and standard deviation represent quantitative data. The Chi-square test was used to investigate the relationship between academic performance and teaching approaches to the preferred learning style.

**RESULTS:** Kinesthetic learning was the preferred sensory modality. Nearly 61.8% of medical students were female. The most common preferred learning style among them was (36.8%) kinesthetic, followed by (36.1%) auditory. Most of them received good academic results (64.8%), followed by average (21.9%) results. Most of the students had chosen a demonstration (81.2%), followed by an interactive lecture (77.2%), as their preferred teaching method. There is a significant association of learning style with participant age ( $p$  0.007), year of study ( $p$  0.0001), and preferred teaching methodologies like a demonstration, small group discussion, self-presentation, and laboratory work, which is statistically significant. There is no association between learning style and academic performance.

**CONCLUSION:** Different teaching approaches, such as demonstration, small-group discussion, self-presentation, and laboratory work, were related to the various learning styles of the students. We also determined that the individuals' preferred learning styles do not affect their academic achievement.

## Keywords:

Academic performance, learning, medical education, teaching method

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## Introduction

Learning and teaching methods for medical students are constantly

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evolving worldwide.<sup>[1]</sup> "Learning style" is "the approach that a learner adopts in the learning process, which involves the learning strategies that have been stabilized

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within a learner, the preference of some instructional stimuli, and learning inclinations." Learning styles rely on how people perceive and process information to understand.<sup>[2]</sup> In recent years, researchers have explored learning styles, and instructors must know and use the best strategies to assist students to learn.<sup>[3]</sup>

Most students are concerned with factual memory, which fragments their comprehension and prevents critical thinking.<sup>[4]</sup> Basic science medical professors must recognize the varied learning styles of medical students and devise teaching strategies to inspire and improve performance. Students learn best when teaching and evaluation approaches match their learning styles. The National Medical Commission's graduate medical education directives stress active learning, learner-centric approaches, self-directed learning, and competency-based learning.<sup>[5]</sup>

Students and teachers must learn a lot in a short time in the medical curriculum.<sup>[6]</sup> The curriculum has improved academic performance with a view to problem-solving skills, clinical fieldwork performance, grade point average (GPA), and course completion.<sup>[7]</sup> Higher education is focusing more on learning styles. Matching learning styles to a framework has increased test results, but mismatching learning styles and curriculum has led to low academic attainment.<sup>[8]</sup> Understanding a student's personality and learning style helps teachers.<sup>[9]</sup> Learning styles and academic achievement are still unresolved concerns.<sup>[10]</sup> In past, many studies were available about learning styles and their impact on teaching methodologies. Moreover, post-COVID-19 lockdown, online learning gained importance, and only a few studies have explored the learning styles' impact on teaching methodologies during this period. In addition, the sudden introduction of a new CBME curriculum further stirred up the learning outcomes, and no adequate data are available regarding the effect of learning styles on academic performances. Therefore, the current study aims to evaluate the various learning styles of undergraduate medical students and their relationship with preferred teaching methodologies and academic scores in university examinations.

## Materials and Methods

### Study design and setting

This cross-sectional study was conducted between January 2022 and December 2022 with undergraduate medical students at a teaching medical college in the Perambalur district of Tamil Nadu, India.

### Ethical consideration

Before beginning the project, approval was obtained from the Institutional Ethics Committee of Dhanalakshmi

Srinivasan Medical College and Hospital (approved number: IECHS/IRCHS/N0: 138), and informed consent was taken before collecting the data.

### Study participants

The study comprised undergraduate medical students from a teaching medical college in the Perambalur region of Tamil Nadu, India, who will take part.

### Sample size and sampling technique

Using the VARK model, Assad Ali Rezigalla *et al.*<sup>[2]</sup> conducted a study to describe the preferred learning styles of undergraduate medical students, finding that 55.9% of these students preferred an auditory style of learning. The final estimated sample size with a 95% confidence interval and a 5% allowable error by using the formula  $n = 3.84^2 * P * Q / d^2$  [ $P = 55.9$ ,  $Q = 44.1$  (100-60.9),  $d = 5$ ]. The approximate sample size is 379. With a non-response rate of 10%, the expected final sample size was 416. The study gathered information from 421 participants. A probability proportional to size sampling strategy has been used to choose the medical students for each year.

### Data collection tool and technique

The researchers created a questionnaire using the G suite application and sent it through social media sites and other applications to evaluate the objective. The questionnaire has 3 parts: the sociodemographic profile, the VARK model questionnaire, and preferred teaching approaches.

The first section includes sociodemographic information, age, gender, academic year, and university identification number.

In the second section, the VARK model was used as a standardized questionnaire. Neil Fleming offered a VARK (sometimes VAK) model in which the learning of students is influenced by their four sensory preferences: visual, auditory, read/write, and kinesthetic.<sup>[11]</sup> To better understand each participant's preferred method of instruction, they were asked to select one of the following learning styles. There are four main types of learning; 1) visual (learning from pictures, charts, flowcharts, and demonstrations); 2) aural (learning from listening to and taking part in lectures and debates); 3) reading/writing; and 4) kinesthetic (learning via doing) (Learning through activity performance, feel, auditory, aroma, and flavors). The VARK survey was conducted by using G Suite. There were 16 questions, each with four choices.

The third section contains information on the most preferred teaching methods, including demonstration, group discussion, problem-based learning, and self-study, among others.

The researchers categorized the academic performance of each individual as poor (50 percent), average (50-59 percent), good (60-74 percent), and excellent (75 percent) based on their university examination score, which the researchers got from the academic office and cross-verified using their university registration number; the first-year students were excluded from the study because they had not yet taken their university examination.

**Statistical analysis**

The obtained data were entered into Microsoft Excel (Redmond, WA: Microsoft Corporation) and analyzed with SPSS version 21 software (IBM Corp., Armonk, NY). Frequency and percentage were used to represent qualitative data, whereas mean and standard deviation were used to represent quantitative data. The Chi-square test was used to investigate the relationship between academic performance and teaching approaches to preferred learning styles. A P value less than 0.05 was statistically significant.

**Result**

The participants’ ages ranged between 18 and 25 years, with a mean of 21.7 ± 1.28 years. The majority were females (61.8 percent). Tabulated in Table 1 are the socio-demographic characteristics of study participants.

Based on the VARK learning style questionnaire, the most preferred learning style among study participants was kinesthetic (36.8 percent), followed by auditory (36.1 percent), visual (16.9 percent), and reading/writing (10.2 percent) [Figure 1].

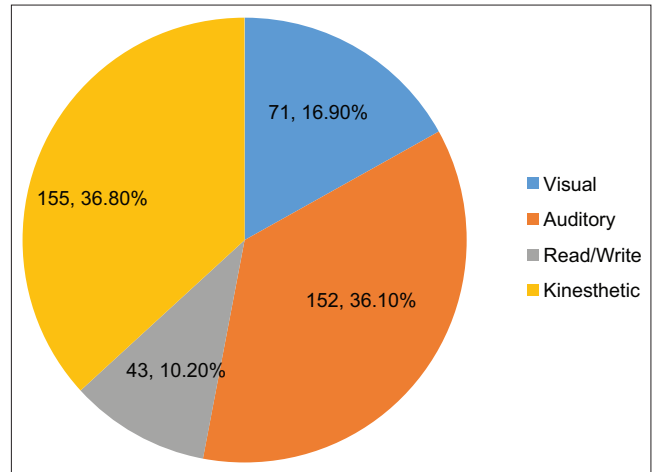
We categorized the study participants according to their academic performances as poor (3.8%), average (21.9%), good (64.8%), and excellent (9.5%) [Figure 2].

Figure 3 summarizes students’ preferences for different teaching methods. Most students chose demonstration as their preferred teaching approach (81.2%), followed by an interactive lecture (77.2%), problem-based learning (74.9%), and small group discussion (72.3%).

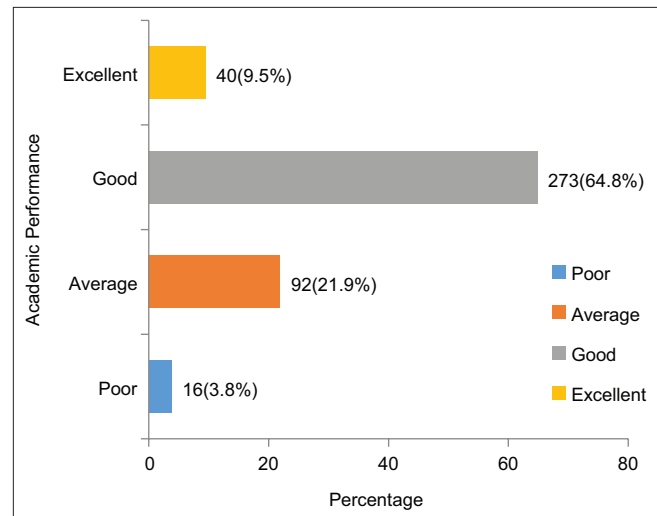
**Table 1: Socio-demographic data of study participants (n=421)**

Characteristics		Frequency	Percentage
Age	≥21	187	44.4%
	>21	234	55.6%
Gender	Male	161	38.2%
	Female	260	61.8%
Year of Education for undergraduate medical students	Second year	75	17.8%
	Third year	100	23.8%
	Final year	107	25.4%
	Internship	139	33%

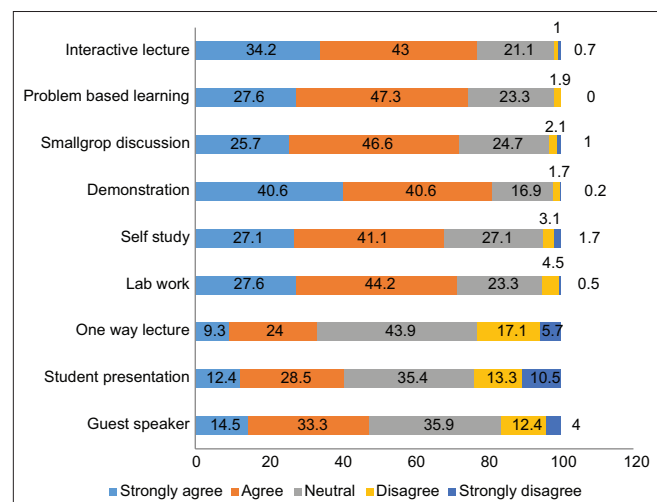
Table 2 displays the relationship between academic performance and learning styles. We found only the



**Figure 1: Learning styles of the study participants (n = 421)**



**Figure 2: Academic performance of study participants (n = 421)**



**Figure 3: Preferred teaching methodologies among study participants (n = 421)**

participant’s age ( $p = 0.007$ ) and study year ( $p = 0.0001$ ) to have a statistically significant relationship with the learning style. Participants older than 21 favor the kinesthetic learning approach, and students younger than 21 prefer the auditory learning style. Similarly, students in their third and final year of the study chose the kinesthetic learning technique over those in their second year and internship who preferred the auditory style. Such age and academic year disparities in learning style preferences were statistically significant.

Table 3 displays the relationship between learning style and academic performance. Most of those who chose kinesthetic learning scored above 50 percent on their university examinations, whereas those who performed poorly on their university examinations favored auditory learning, which is not statistically significant ( $p > 0.05$ ).

We have studied the relationship between learning style and teaching methods among medical students. Most of them favored demonstration, small group discussion, and laboratory work (39.8 percent, 38.7 percent, and 38.7 percent, respectively) over self-presentation (which is statistically significant) as their teaching technique ( $p$  less than 0.05). Auditory learning style is not statistically significant among participants who choose interactive lectures, self-study, unidirectional learning, and guest speaker lectures.

### Discussion

Teaching aims to facilitate the learning process, and understanding the learning behavior of students is an integral element of this process. Therefore, the concept of learning styles seems to have become a popular issue in recent literature, with many learning style theories

proposed to better comprehend the dynamic learning process.<sup>[11]</sup> It might stimulate students to take part in these programs and gain professional expertise.<sup>[12]</sup>

This study has examined medical students’ learning styles. Another goal was to show how age, gender, year of study, academic success, and preferred teaching methods affect students’ learning styles. In medicine, where students need vast, in-depth knowledge and high-level skills, educators must grasp how learning styles and these elements relate. This study aims to improve our medical education.

In the analysis, the most popular learning technique is kinesthetic at 36.8%. Similarly, according to a 2016 study performed in Saudi Arabia, kinesthetic learning is favored among dental students (35.1 percent),<sup>[13]</sup> and also in Malaysia, 30.1% of undergraduate medical students favored kinesthetic learning.<sup>[14]</sup> In a research performed in Bengaluru, India, in 2022, the preferred learning technique of anatomy students was kinesthetic.<sup>[15]</sup> In contrast, a 2016 study conducted by Habibpour *et al.*<sup>[16]</sup> among medical students in Iran revealed that reading/writing was the most prevalent learning method. Also, a study conducted by Urval *et al.*<sup>[4]</sup> in India revealed that the preferred learning style of medical students was auditory (45.5 percent). Seventy-one percent of students in most courses at the medical school in Romania require that visual presentation be supported by a coherent discourse in which they stressed key parts with tonal variations.<sup>[17]</sup> Regional heterogeneity and individual student viewpoints on choosing a learning style for learning account for these disparities.

In the present study, medical students chose demonstration 40.6% of the time, interactive lecture

**Table 2: Association of preferred learning styles based on basic characteristics of study participants (n=421)**

Characteristics		VARK model				P
		Visual n (%)	Auditory n (%)	Read/write n (%)	Kinesthetic n (%)	
Age	≤21	25 (13.4%)	78 (41.7%)	11 (5.9%)	73 (39%)	0.007*
	>21	46 (19.7%)	74 (31.6%)	32 (13.7%)	82 (35%)	
Gender	Male	30 (18.6%)	62 (38.5%)	20 (12.4%)	49 (30.4%)	0.170
	Female	41 (15.8%)	90 (34.9%)	23 (8.8%)	106 (40.6%)	
Year of study	Second year	9 (12%)	39 (52%)	6 (8%)	21 (28%)	<0.001*
	Third year	12 (12%)	40 (40%)	5 (5%)	43 (43%)	
	Final year	17 (15.9%)	29 (27.1%)	9 (8.4%)	52 (48.6%)	
	Internship	33 (23.7%)	44 (31.7%)	23 (16.5%)	39 (28.1%)	

\*P value less than 0.05 was statistically significant and analyzed by using the Chi-square test

**Table 3: Association of learning styles (VARK model) on academic performance of study participants**

Characteristics		Visual n (%)	Auditory n (%)	Read/write n (%)	Kinesthetic n (%)	P
Academic performances	Poor	5 (25.7%)	5 (29.3%)	1 (6.3%)	5 (27%)	0.623
	Average	10 (10.9%)	33 (35.9%)	11 (12%)	38 (41.3%)	
	Good	51 (18.7%)	99 (36.3%)	28 (10.3%)	95 (34.8%)	
	Excellent	5 (12.5%)	15 (37.5%)	3 (7.5%)	17 (42.5%)	

\*P-value less than 0.05 statistically significant analyzed by using the Chi-square test

34.2% of the time, and problem-based learning and laboratory work 27.6% of the time. The one-way lecture was the least desired teaching approach at 9.3 percent. In Pakistan, interactive lecturing and problem-based learning were favored over one-way lectures, according to a similar study.<sup>[3]</sup> Research in India revealed that practical/dissections were the preferred method of instruction among first-year medical students (39 percent), followed by lectures (32 percent).<sup>[18]</sup> The study in Pakistan found that the top three teaching approaches were small group discussion, problem-based learning, and presentation of models.<sup>[19]</sup>

There is a substantial association between learning style and age and study year; however, no association was found between gender and learning style. In contrast, a study conducted in Saudi Arabia revealed a considerable variation between genders' preferred learning styles.<sup>[8]</sup> Dobson found that male and female students in physiology classes had significantly different learning methods.<sup>[20]</sup> Choudhary *et al.*<sup>[9]</sup> reached the same conclusion among first-year students. Neither Alkhasawneh *et al.* nor Dobson, in separate research, discovered any variations in learning styles based on gender.<sup>[21,10]</sup>

In this study, no significant association was seen between learning style and academic performance. Similarly, a study conducted in India by Urval *et al.*,<sup>[4]</sup> Iran (2020),<sup>[13]</sup> West Indies,<sup>[22]</sup> Sri Lanka,<sup>[1]</sup> Malaysia,<sup>[14]</sup> and Thailand<sup>[12]</sup> show a negative association between learning style and academic performance. In contrast, a study conducted in India (2021)<sup>[15]</sup> and Iran (2016),<sup>[16]</sup> Saudi Arabia,<sup>[8]</sup> and Turkey<sup>[23]</sup> showed a positive association between learning style with academic performance. These disparities are primarily because of variances in sample size and the categorization of academic performance grading systems.

In the current study, no association was noticed between learning styles and preferred teaching approaches or between learning styles and academic performance. Research conducted in Pakistan revealed similar results.<sup>[3]</sup> Their field of study, instructional methods, learning experiences, curriculum material, and course load may influence the prevalence of certain learning styles among students. Therefore, it is stated that teachers pay more attention to the various learning styles of their pupils while developing lesson plans.

### Limitation and recommendation

The sample came from a single institution; thus, the results may not show all medical students in various medical schools in varying geographical locations and teaching contexts around the world. Future research to validate this observation will be useful. Our research

on the teaching techniques of medical instructors includes data from medical faculties with varying levels of expertise, genders, and academic ranks. The heterogeneity of these data may prevent researchers from drawing generalizable findings regarding the harmonization of preferred teaching approaches because of the diversity of community demands and teacher expertise. Although we have established substantial relationships, it will be beneficial to continue with future research, including more samples and subjects. It would be fascinating to do a longitudinal study to determine how a medical student's learning style preference may alter over time and how this affects his or her performance in different disciplines. Last, this study did not adjust for the influence of factors such as IQ and personality, which have repeatedly shown predictive power over academic achievement in the literature. Every institution has to understand their students' learning preferences to apply better teaching methods and, in turn, raise the student to achieve better levels.

## Conclusion

This current research aimed to characterize the learning styles of medical undergraduates at our institution. The favored sensory modality for learning was kinesthetic. Different teaching approaches, such as demonstration, small-group discussion, self-presentation, and laboratory work, were related to the various learning styles of the students. We also determined that the individuals' preferred learning style does not affect their academic achievement. We believe this data will assist us in refining our course material and enhancing the learning experience.

### Acknowledgment

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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