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Original Research Article

Role of learning style preferences in academic performances among preclinical medical students in a tertiary medical college, Kolkata: a cross-sectional study

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ABSTRACT

Background: The number of medical colleges in India has been increasing at a higher rate in the past few years; this increased influx of students would benefit from a system that was more in line with their preferences. Many studies have used the visual, aural/auditory, read/write, kinesthetic (VARK) learning preferences questionnaire, allowing an opportunity to use another questionnaire to determine learning style preferences that is the index of learning styles (ILS) by Felder and Soloman.
Methods: A non-probability convenient sampling technique was used to enroll the study participants during period of data collection. This cross-sectional study investigated preclinical medical students to determine learning style preferences and correlate with academic performance across gender. Questionnaires were sent through google forms and 178 preclinical medical students at a tertiary care institute in Kolkata were enrolled.
Results: The study population consisted of 1st and 2nd year students at the institute. It was found that a higher percentage preferred visual (89.89%), sensing (60.11%), reflective (53.90%) and sequential (57.30%) learning styles over the alternatives. However, no significant association was found between learning styles and academic performance.
Conclusions: If instruction methods heavily favor one type of learning style over another, students with different learning styles may not learn optimally, while students whose learning styles match with the instruction will not be encouraged to develop skills in their less preferred learning styles. The findings from this study will aid in future re-examination of current teaching methods and evaluate whether they are optimally balanced with respect to the students.

Keywords: Academic performance, Index of learning styles, Learning style preferences, Medical students, Questionnaires and surveys

INTRODUCTION

Learning styles could be defined as "an individual's natural, habitual and preferred way of absorbing, processing and retaining new information and skills".[1] While the course structure has set specific skills and knowledge milestones, how each individual attains such skills and milestones may be different based on their learning styles. Any shortcomings in the initial results may lead to many students, who had initially adopted a learning style that came to them naturally, being forced to only adopt those methods that guarantee results in a one-track testing system. Lectures have been the primary source of instruction for medical students, especially in the preclinical years. Attendance in these lectures has steadily decreased over the years.[2] Bertolami has proposed that one reason for students' frustration towards the curriculum is the inconsistency between learning

content and the instructor's teaching methods.[3] Learning style assessment coupled with faculty mentoring has been found to help the development of effective study skills.[4] Since, in the later years of the course, students inadvertently adapt to learning in a manner that translates to results in the current system, this study included newly inducted students into the course and still in the early stages of the course, namely those students in the preclinical years. The significance of this study is that it attempts to determine the distribution of different learning style preferences among medical students in the preclinical years of their course. Further, it attempts to correlate academic achievement with the different learning styles defined according to their sex. Various studies have been published to determine learning style preferences in disciplines such as dental students and health sciences students.[5-7] The gap in knowledge presents itself in that many of these studies have used the visual, aural/auditory, read/write, kinesthetic (VARK) learning preferences questionnaire, allowing an opportunity to use another questionnaire to determine learning style preferences.[8] This study has made use of the index of learning styles (ILS) developed by Felder and Soloman and divided the participants into different learning style preferences as explained in "learning style and strategies".[9,10] This has resulted in the characterization of the participants by values in four dimensions as per the Felder-Silverman model of learning styles. They show how students prefer to process (active-reflective), perceive (sensory-intuitive), receive (verbal-visual) and understand information (sequential-global). A cross-sectional study by Dobson (2008-2009) in Florida used a unique questionnaire that classified students into sensory modalities based on the VARK questionnaire.[5] The study focused on investigating the relationship between preferred learning style, gender, and course scores in an undergraduate physiology class. A cross-sectional study by Wong et al in Malaysia used purposive sampling and administered the VARK questionnaire.[6] This study also investigated the differences in preferred learning styles between high achievers and non-high achievers. A cross-sectional study by Padmalatha et al in Karnataka also used the VARK questionnaire and the participants were first-year MBBS students.[7] While one of these studies has compared academic performance with resultant learning style preferences obtained, they did so after administering the VARK questionnaire or unique questionnaires based on VARK, whereas this present study did so after administering the index of learning styles questionnaire.[5,7] Thus, based on the status of knowledge, this study has administered a scale less used in the context of the topic and attempted to find any statistically significant difference in the associated academic performance according to gender specifically among preclinical medical students.

Thus, the objectives of the study can be enumerated as follows:

To elicit the different learning styles preferred by the study participants. To find out the academic performance of those study participants according to their learning style preferences. To measure an association between learning style preference and academic performance according to selected demographic characteristics.

METHODS

This study was set in a tertiary medical college located in the city of Kolkata, and was conducted for a period of two months from October 2023 to December 2023. Preclinical medical students of the tertiary medical college constituted the population for the study which was designed to be a cross-sectional observational study.

Selection criteria

Inclusion criteria for choosing participants for this study were those who were aged >18 years, studying in the 1st/2nd year of their course (preclinical years) and those who consented to participate. Study questionnaires were sent through a link on their email address.

Those who submitted incomplete questionnaires were excluded from the study.

Sample size

According to the qualitative method of sample size calculation in cross-sectional studies, we have:[11]

Z=Standard Normal variate at level of significance, here α considered 5%, hence $Z_{\alpha/2}$=1.96

Anticipated prevalence (P) =0.69.[12]

Precision (d) =0.05

According to the formula, the sample size,

$$n = \frac{Z^2 p(1-p)}{d^2}$$

$$n = \frac{1.96 \times 0.69 \times 0.31}{0.0025}$$

=167

Sampling technique

A non-probability convenient sampling technique was used to enroll the study participants during a defined period (October-December of 2023) of data collection.

Study tools

A socio-economic data sheet was used to find demographic profile of the study participants. The index

of learning style (ILS) questionnaire was applied to segregate the participants according to their learning styles as defined by the questionnaire. The ILS questionnaire determines learning style based on the following four scales, each containing two dimensions of learning style:[10]

Processing information

Active (these learners tend to retain and understand information best by discussing or applying it or explaining it to others) or reflective (prefer to think about it quietly first).

Perceiving information

Sensing (tend to like learning facts) or intuitive (often prefer discovering relationships and possibilities).

Receiving information

Visual (these learners do better with pictures, diagrams, and graphs) or verbal (prefer written or spoken explanations).

Understanding information

Sequential (tend to gain understanding with a step-by-step approach that is logical) or global (absorb the material in large jumps almost randomly without connections with an understanding of the whole content coming later).

Data collection regarding academic performance in a recent set of examinations was also done through google form link.

Study procedure/data collection

The study was conducted with preclinical medical students by handing them questionnaires that determined their learning style preferences and academic performance in a recent set of examinations.

Statistical analysis

The dataset included both quantitative and qualitative variables. Data management was initially carried out using Microsoft Excel (version 7.0), and subsequently, the dataset was imported into IBM SPSS Statistics (version 16.0) for statistical analysis. Data analysis was performed using both univariate and bivariate techniques, as appropriate.

Qualitative variables were summarized using frequencies and corresponding percentages. Quantitative variables were presented using descriptive statistics: the mean and standard deviation (SD) were reported for normally distributed data. The association between two categorical variables was assessed using the Chi-square (χ^2) test when the expected frequency in each cell was greater or equal to 5. If any expected cell frequency was below 5, the Chi-square test with Fisher's Exact test was used.

A p value of less than 0.05 was considered statistically significant.

Ethical considerations

The study was conducted after obtaining clearance from the institutional ethics committee. The confidentiality of data was maintained.

RESULTS

Objective 1

In the scale of processing information, it was found that the number of active and reflective learners constituted an almost equal part of the study population. In the active dimension, out of 82 participants majority 59 (71.95%) of them were balanced in their preference, while only 22 (26.83%) and 1 (1.22%) of the participants had moderate and serious priority, respectively. In the reflective dimension, out of 96 participants, more than half 54 (56.25%) were balanced in their preference, while 34 (35.42%) had a moderate priority for the reflective dimension and 8 (8.33%) had a serious priority towards this dimension. In the scale of perceiving information, it was found that out of 178 participants, 107 (60.11%) preferred learning facts (sensing learners), whereas 71 (39.89%) preferred discovering relationships and possibilities (intuitive learners). In the sensing dimension, out of 107, more than half 57 (53.27%) were balanced in their preference, while 41 (38.32%) had a moderate priority, and only 9 (8.41%) had a serious priority for the sensing dimension. In the intuitive dimension, out of 71, the majority 46 (64.79%) were balanced in their preference, whereas 23 (32.39%) and 2 (2.82%) had moderate and serious priority, respectively, for intuitive dimension.

Table 1: Frequency distribution of Socio-demographic profile for the study participants (n=178).

Variables	Frequency (%)
Age (in years)	
Mean±SD	20.8±1.47
Sex	
Male	92 (51.7)
Female	86 (48.3)
Religion	
Hindu	152 (85.4)
Muslim	22 (12.4)
Christian	4 (2.2)
Participants year of MBBS study	
1st year	75 (42.1)
2nd year	103 (57.9)

Table 2: Distribution of grades in a recent set of examinations (n_1+n_2 =178) of 1st and 2nd year students.

Grade (%)	Frequency (%)
1st year n_1=75 (42.13%)	
1 (51-60)	24 (32)
2 (61-70)	9 (12)
3 (71-80)	7 (9.33)
4 (81-90)	16 (21.33)
5 (91-100)	19 (25.33)
2nd year n_2=103 (57.86%)	
Grade (%)	**Frequency (%)**
1 (51-60)	25 (24.27)
2 (61-70)	42 (40.78)
3 (71-80)	26 (25.24)
4 (81-90)	7 (6.80)
5 (91-100)	3 (2.91)

In the scale of receiving information, learners who preferred diagrams graphs (visual learners) constituted the majority (89.89%) at 160 participants out of 178, while verbal learners numbered at 18, constituting 10.11%. In the visual dimension, 81 (50.63%) had a moderate priority for this dimension, while 42 (26.25%) were balanced in their preference, and 37 (23.13%) had a serious priority for the visual dimension. In the verbal dimension, the majority 14 (77.78%) were balanced in their preference while 3 (16.67%) and 1 (5.56%) had moderate and serious priority respectively for this dimension.

In the scale of understanding information, sequential learners constituted more than half of the total number of participants at 102 (57.30%), and global learners were numbered at 76 (42.70%) out of 178. In the sequential dimension, out of 102, more than half 57 (55.88%) were balanced in their preference, whereas 40 (39.22%) and 5 (4.90%) had moderate and serious priority, respectively for this dimension.

In the global dimension, out of 76, the majority 55 (72.37%) were balanced in their preference, while 18 (23.68%) had a moderate priority for this dimension, and only 3 (3.95%) had a serious priority for the dimension.

Objective 2

For ease of statistical analysis, 3 categories were made as such: Category I: all participants with marks scored in the range of grade 1. Category II: sum of all participants with marks scored in the ranges of grade 2 and grade 3. Category III: sum of all participants with marks scored in the ranges of grade 4 and grade 5 (Figure 1).

Objective 3

Association tables

The academic performance of the study participants according to their learning style preference was found by forming three sets of classes for each scale (having dimensions 1 and 2) as such.

Balanced: Sum of all participants who are balanced in their preference for either dimension of a scale

Dimension 1 (moderate/serious): sum of all participants who have moderate and serious priority for dimension 1 of the concerned scale.

Dimension 2 (moderate/serious): sum of all participants who have moderate and serious priority for dimension 2 of the concerned scale.

The distribution of the participants' grades included in the 3 classes was thus made for each of the 4 scales (processing, perceiving, receiving, and understanding information) respectively. Results have been tabulated in Table 3 and 4.

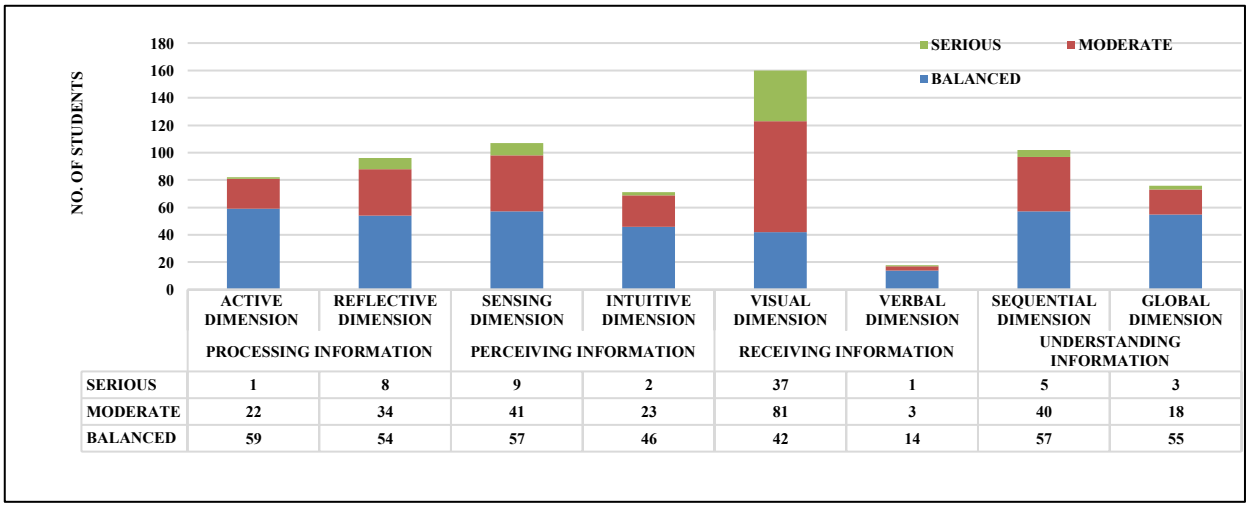

Figure 1: Frequency distribution of priority of students towards each dimension of learning styles.

Table 3: The categorical variables (learning style preference and academic performance category) for each scale were tested for association using the Chi-square test.

Learning styles	I	II	III	Total	χ^2	P value
Processing information						
Balanced (active/reflective)	28	55	30	113	5.083	0.279
Active (moderate/serious)	5	14	4	23		
Reflective (moderate/serious)	16	15	11	42		
Total no. of participants in each category	49	84	45	n=178		
Perceiving information						
Balanced (sensing/intuitive)	22	53	28	103	8.72	0.068
Sensing (moderate/serious)	18	24	8	50		
Intuitive(moderate/serious)	9	7	9	25		
Total no. of participants in each category	49	84	45	n=178		
Receiving information						
Balanced (visual/verbal)	16	27	13	56	5.182	0.269
Visual (moderate/serious)	30	56	32	118		
Verbal (moderate/serious)	3	1	0	4		
Total no. of participants in each category	49	84	45	n=178		
Understanding information						
Balanced (sequential/global)	30	49	33	112	4.79	0.31
Sequential (moderate/serious)	11	24	10	45		
Global (moderate/serious)	8	11	2	21		
Total no. of participants in each category	49	84	45	n=178		

Table 4: The categorical variables (learning style preference and academic performance category) for each scale according to gender were tested for association using the Chi-square test.

Learning styles	Males						Females					
	I	II	III	Total	χ^2	P value	I	II	III	Total	χ^2	P value
Processing information												
Balanced (active/reflective)	15	27	13	55	6.28	0.602	13	28	17	58	8.72	0.068
Active (moderate/serious)	4	7	3	14			1	7	1	9		
Reflective (moderate/serious)	12	5	6	23			4	10	5	19		
Total no. of participants in each category	31	39	22	92			18	45	23	86		
Perceiving information												
Balanced (sensing/intuitive)	11	26	12	49	9	0.061	11	27	16	54	2.36	0.669
Sensing (moderate/serious)	13	9	4	26			5	15	4	24		
Intuitive (moderate/serious)	7	4	6	17			2	3	3	8		
Total no. of participants in each category	31	39	22	92			18	45	23	86		
Receiving information												
Balanced (visual/verbal)	10	12	8	30	2.19	0.7	6	15	5	26	5.59	0.232
Visual (moderate/serious)	20	27	14	61			10	29	18	57		
Verbal (moderate/serious)	1	0	0	1			2	1	0	3		
Total no. of participants in each category	31	39	22	92			18	45	23	86		
Understanding information												
Balanced (sequential/global)	23	23	15	61	2.69	0.611	7	26	18	51	8.22	0.084
Sequential (moderate/serious)	4	11	5	20			7	13	5	25		
Global (moderate/serious)	4	5	2	11			4	6	0	10		
Total no. of participants in each category	31	39	22	92			18	45	23	86		

DISCUSSION

The results of this study speak of most students preferring to receive information in the form of graphs and diagrams; an overall visual depiction of the information (visual learners) being conveyed by teachers is prioritised by the students over information that is explained through writing or speaking. Additionally, it was also found that a higher percentage of students preferred information in the form of facts that connect to the real world (sensory learners) over abstract information pertaining to concepts, theories and discovering possibilities. A slightly higher percentage of students preferred learning in a sequential manner (sequential learners); these tend to gain understanding with a step-by-step approach that is logical rather than randomly absorbing material in large jumps. Meanwhile, as per the results, the population was almost equally divided among students who preferred to process information actively and those who preferred processing information in a reflective manner.

Chi-square test was done to test the statistical significance of this distribution, if any, taking p value <0.05 as significant (Table 3). It was found that only one value was close to this, indicating a possible statistically significant association between students who preferred the sensing style and their academic performance. The chi-square test showed no other significant association of active-reflective, visual-verbal, sequential-global learning style preference with academic performance. The results of the chi-square tests from Table 4 showed no statistical significance between learning style preferences and academic performance according to gender.

These findings may be reflected by the examination scores that was voluntarily entered by the study participants and not drawn from any records; hence, any accuracy of the scores received depends on the individual participant's discretion, regardless of the promise of confidentiality of the data. An additional factor to consider is that almost half of the 1st year students reported scoring more than 80%, whereas a significantly smaller percentage of 2nd year students scored more than 80%. This variation may have arisen from the fact that the recent set of examinations passed by the 1st and 2nd years differ majorly in the subjects tested and the trend of scoring patterns.

The recent set of examinations given by newly admitted 1st year students were school-leaving examinations that tested knowledge in subjects far different from the ones in the examinations conducted on 2nd year students. This study has made use of the ILS questionnaire to determine learning style preferences of the study participants. This tool is seen as time efficient and is also free of cost in a non-commercialized setting.[13] These above-described factors may have led the results to be statistically insignificant, but there are indications that without the presence of these factors, some of the results may have been significant as they were close to the (P) value <0.05 taken as significant.

The results of many studies in medical schools regarding learning style preferences show a tendency for sensing, visual, and sequential dimensions of learning.[14-16] In the study by Hernández-Torrano et al, it was found that a higher number of students prefer sequential and visual styles of learning.[17] While almost an equal number of students preferred active and reflective styles of learning. Similarly, there was very little difference in the number of students who preferred sensing styles and those who preferred intuitive styles of learning. Some studies point out that there is no relation between learning style preferences and academic performance.[15,18] On the other hand, some studies have also described an association between academic performance and different learning style preferences.[17,19] In the present study, an attempt was made to find the association of learning style preferences and academic performance according to gender among preclinical medical students.

Hence, based on these results and the above discussed shortcomings of the experimental design followed here, it cannot be said with confidence that there exists no association of learning style preferences with academic performance across gender. The approach of instruction should not be aimed to be tailored exactly to fit individual preferences. If instruction methods heavily favor one type of learning style over another, students with different learning styles may not learn optimally, while students whose learning styles match with the instruction will not be encouraged to develop skills in their less preferred learning styles. Hence, the optimal teaching method is a balanced one that does not let students become overly dependent on their preferred learning styles and allows them to increase their familiarity with other learning styles, which they may have avoided given an option.

CONCLUSION

This study may aid in a possible future re-examination of current teaching methods and evaluate whether they are optimally balanced with respect to the students. A significant association between learning styles and academic performance may further help to reach an understanding that current teaching methods lean towards specific learning styles more than others, thus this opens up an opportunity for further research into this topic with a more robust system of tracking the performance of students in different years of study with examinations that are similar in approach and difficulty. This research can be further applied to study at a larger scale the learning style preferences and possible associations in other populations studying different disciplines under the broad category of health sciences administering the questionnaire used in this study for a clearer insight into the shortcomings or strengths of current modes of teaching and learning in different disciplines.

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REFERENCES

1. Reid J. Learning Styles in the ESL. 1st ed. New York: Heinle & Heinle; 1995.
2. Zazulia AR, Goldhoff P. Faculty and medical student attitudes about preclinical classroom attendance. In: Teaching and Learning in Medicine. Vol. 26. Informa UK Limited; 2014:327-334.
3. Bertolami CN. Rationalizing the dental curriculum in light of current disease prevalence and patient demand for treatment: form versus content. J Dent Educ. 2001;65:725-35.
4. Marek GI. Impact of learning style assessment on self-reported skills of students in an associate degree nursing program. In: Teaching and Learning in Nursing. Vol. 8. Elsevier BV; 2013:43-49.
5. Dobson JL. Learning style preferences and course performance in an undergraduate physiology class. In: Advances in Physiology Education. Vol. 33. American Physiological Society; 2009:308-314.
6. Wong RSY, Siow HL, Kumarasamy V, Shaherah Fadhlullah Suhaimi N. Interdisciplinary and inter-institutional differences in learning preferences among Malaysian medical and health sciences students. J Adv Med Educ Prof. 2017:164-71.
7. Padmalatha K, Kumar J, Shamanewadi A. Do learning styles influence learning outcomes in anatomy in first-year medical students? J Fam Med Prim Care. 2022;11(6):2971.
8. Fleming ND. VARK: a Guide to Learning Styles. Available at: http://www.varklearn.com/english/page.asp?p=questionnaire. Accessed on 9 December 2025.
9. Felder RM, Soloman BA. Index of Learning Styles. Available at: https://www.researchgate.net/publication/239597589_Index_of_Learning_Styles. Accessed on 9 December 2025.
10. Felder RM, Soloman BA. Learning styles and strategies. 2007. Available at: http://www.ncsu.edu/felder-public/ILSdir/styles.htm. Accessed on 9 December 2025.
11. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? Indian J Psychol Med. 2013;35:121-6.
12. Samarakoon L, Fernando T, Rodrigo C. Learning styles and approaches to learning among medical undergraduates and postgraduates. BMC Med Educ. 2013;13:42.
13. Felder RM, Spurlin JE. Applications, reliability, and validity of the index of learning styles. Int J Engin Educ. 2005;21(1):103-12.
14. Liu HP, Liu YH. Learning styles of medical students from a university in China. BMC Med Educ. 2023;23(1):237.
15. Tariq S, Khan MA, Afzal S, Shahzad SR, Hamza M, Khan HA, et al. Association between academic learning strategies and annual examination results among medical students of King Edward Medical University. Annals KEMU. 2016;22(2).
16. Kim M, Kim S, Lee J, Ahn D, Lee Y. Characteristics of medical students' learning styles and their relationships to GPA. Korean J Med Educ. 2016;18(2):133-40.
17. Hernández-Torrano D, Ali S, Chan C. First year medical students' learning style preferences and their correlation with performance in different subjects within the medical course. BMC Med Educ. 2017;17(1).
18. Alghasham AA. Effect of students' learning styles on classroom performance in problem-based learning. Med Teach. 2012;34(sup1):S14-9.
19. Hur Y, Kim S. Different outcomes of active and reflective students in problem-based learning. Med Teach. 2007;29(1):e18-e21.

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