

RESEARCH ARTICLE

Learning styles and approaches toward pharmacology curriculum among medical undergraduates

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ABSTRACT

Background: Learning styles (LSs) and learning approaches (LAs) of each medical student vary to a great extent. If LSs and LAs of the students are known, the teaching-learning programs can be developed in an appropriate way for better learning. **Aims and Objectives:** The present study was designed to evaluate the change in LSs and LAs at different semesters of pharmacology curriculum and to correlate LSs and LAs with gender and academic performance in the 2nd year MBBS students. **Materials and Methods:** LSs were determined using visual, auditory, reading/writing, kinesthetic questionnaire. The ASSIST questionnaire was used to assess the LAs adopted by students. Student's 3rd and 5th semester examination marks were considered for evaluating the performance of the students. **Results:** Students in 3rd semester showed almost similar preference for multimodal (51%) and unimodal LS (49%). In the 5th semester, preference of these students for unimodal LS (55%) was higher than for multimodal LS (45%). Quadrimodal was the preferred multi-modal LS in both semesters while auditory was the preferred unimodal LS. Majority of students followed deep approach in both semesters. There was no significant difference in LSs and LAs between genders in both the semesters. Both LSs and LAs were not related to a student's academic performance. **Conclusion:** Students showed diverse LSs, i.e., unimodal and quadrimodal, while majority students preferred deep LA. The teachers have to evaluate the LSs and LAs of students and develop appropriate teaching methods. This can help students perform better both in and out of the classroom.


KEY WORDS: Learning Preferences; Academic Performance; Visual, Auditory, Reading/Writing, Kinesthetic; ASSIST; Gender

INTRODUCTION

Students in medical colleges come from different socioeconomic and cultural backgrounds. They have different prior educational experiences and different levels of competencies. Medical students have different preferences when it comes to the assimilation and processing of the information.^[1]

The term "learning style" (LS) is described as an "individual's preference for understanding his/her experiences and transforming them into knowledge."^[2] The visual, auditory, reading/writing, kinesthetic (VARK) model, which is an acronym for the visual (V), auditory (A), read/write (R), and the kinesthetic (K) sensory modalities was developed by Fleming and Mills.^[3] It provides the learner with a profile of their LSs, based on the sensory modalities which are involved in learning the information. The ways students evaluate the information are different from each other as every person has his or her own learning approach (LA). In general, LA is the way by which individual interacts with the information obtained.^[4]

Three different approaches to learning have been identified, namely, deep approach (DA), surface apathetic approach

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(SAA), and strategic approach (SA). The DA to study is characterized by a student's desire to understand, learn with meaning and recognize underlying principles and connections among related principles. The SA to study is characterized by student's close attention to details such as the structure of the content as laid out in the text, adherence to an instructor's guidelines for studying and expected test format. The SAA to study often involves the student memorizing information and doing what is necessary to succeed in an upcoming assessment.^[5]

ASSIST^[6] (approaches to study skills inventory for students) questionnaire is very commonly used to study these different LAs among students. It provides a useful instrument for providing accessible learning related information which students can reflect on. It also provides a clearly laid out profile of the LAs of each student identified through the administration of a self-report questionnaire.

Pharmacology is a vast and volatile subject. It requires concept clarity and memorization. Students most often memorize pharmacology facts using SAA and rarely use DA and SA. The knowledge gained in pharmacology must be applied while learning medicine and later used in clinical practice. Hence, it is essential that students utilise DA and SA If LS/approaches of the students are known; the teaching-learning program can be developed in an appropriate way for better learning. Few studies conducted^[7-9] in students of business, finance, basic sciences and medicine have attempted to find out an association between LS and approaches with gender or with academic performance. However, most of the studies are inconclusive in developing an association between them. In addition, literature regarding the same is scarce in Indian medical students, and there are no studies to find the learning preferences and approaches of students in the subject of pharmacology.

The present study was designed with the objectives (a) to assess LSs using VARK questionnaire and LAs using ASSIST questionnaire in the students of pharmacology (b) to evaluate the change in LSs and approaches in different semesters of pharmacology curriculum, and (c) to evaluate LSs and approaches with gender and academic performance in pharmacology in the 2nd year MBBS students.

MATERIALS AND METHODS

This cross-sectional study was done at Seth GS Medical College, Mumbai, India, after obtaining the Institutional Ethics Committee approval. Written informed consent was obtained from all the participants. The study involved undergraduate students of 2nd-year MBBS. VARK and ASSIST questionnaires were downloaded from <http://vark-learn.com/wp-content/uploads/2014/08/The-VARK-Questionnaire.pdf> and www.etl.tla.ed.ac.uk/questionnaires/ASSIST.pdf, respectively. Both prevalidated questionnaires were administered to the students

(3rd semester) in the month of September 2014. Students of the same batch were again administered both the questionnaires after 1 year (now in 5th semester). Students were given time of 35–40 min to fill the questionnaires. Only completely filled questionnaire was considered and the data from these forms were subsequently analyzed.

In the VARK questionnaire, (version 7.8) there were 16 questions with 4 options each, representing four major sensory modes of learning: VARK. Students were allowed to choose multiple answers for each question to adequately describe their preferred response(s) to the situations presented. The total number of student responses were tallied for each of the four sensory modalities (V, A, R, and K) and for all possible combinations of the modalities (e.g. VA and VRK). In the VARK questionnaire, the subscale scores according to protocol were calculated and then preferred LS, i.e. visual (V), auditory (A), reading-writing (R) or kinesthetic (K) and unimodality or multimodality according to subscale scores were determined. These scores were entered in the excel sheet and emailed to the copyright holder of the questionnaire, Neil D Fleming, for converting them into VARK categories using research algorithm.

In ASSIST questionnaire (short version), there were 52 items with responses on a 5 point Likert scale where 1 = disagree and 5 = agree. In the ASSIST questionnaire, subscale scores were calculated for each approach individually, and the predominant LA, namely, SAA, DA, and SA was calculated using the subscale scores.

The teaching-learning program for pharmacology for the above batch consisted of 110 lectures (90 large group interactive lectures, 10 reinforcing learning modules, and 10 student symposia), 24 practicals and 17 tutorials. Marks obtained in the subject of pharmacology at the end of the 3rd semester (total marks - 90; theory - 50 marks and practical - 40 marks) and 5th semester (total marks - 120; theory - 80 marks and practical - 40 marks) were entered in the excel sheet.

Statistical Analysis

The data was analyzed using GraphPad in Stat (version 3.06) software. Results were presented in terms of number and proportions. Chi-square test was used to detect significance between LSs and approach with gender. To compare the academic performance with LSs and LAs, one-way ANOVA test was used. $P < 0.05$ was considered as statistically significant. Since total marks in the 3rd semester (90 marks) and 5th semester (120 marks) were different, all marks were converted to a percentage and then compared.

RESULTS

Out of 182 students, 145 students (79.67%) gave consent for participation in the study. Out of these 145 students,

112 students filled the form completely in 3rd semester. Out of 112 students, 65 were males and 47 females. However, 129 students filled the form completely, and these forms were analyzed in 5th semester. The gender breaks down for 5th semester was 71 males and 58 females.

Students in 3rd semester showed preference for unimodal style (49%; auditory - 20%, visual - 16%, kinesthetic - 9%, reading-writing - 4%). Preference for reading-writing style was seen only in few students. Multi-modal style accounted for 51% students (Quadrimodal- 47% and bimodal- 4%). Bimodal preference was seen in very few students and trimodal preference by none. Students in the 5th semester showed preference for unimodal style (55%) than multi-modal style (45%). Among the students having preference for unimodal style, although preference for auditory style remained similar, there was an increasing trend seen for kinesthetic style, i.e., from 9% to 20% from 3rd to 5th semester; this increase was not statistically significant ($P = 0.08$) [Table 1, Figures 1 and 2].

Table 1 shows the gender wise distribution of LSs in the students for both the semesters. The comparison between LSs of the students and gender was statistically insignificant (Chi-square test $P = 0.69$, 3rd semester and $P = 0.57$, 5th semester) for multimodal and unimodal preference. The number of male students having preference for kinesthetic LS showed an increased trend from 3rd semester to 5th semester, i.e., 5%–13%. There was no statistically significant difference between academic performance and LS of students in both the semesters ($P = 0.653$, 3rd semester and $P = 0.872$, 5th semester) [Table 2].

The majority of students in their 3rd semester, as well as 5th semester, were following DA (59% and 50%, respectively) followed by SA (27% and 32%, respectively) for learning. Only 9 students switched from DA or SA to deep-strategic mixed approach of learning from 3rd to 5th semester. No significant gender variation in LAs was seen in students during their both semesters (Chi-square test, $P = 0.87$, 3rd semester and $P = 0.55$, 5th semester) [Table 3, Figures 3 and 4].

The mean scores of students with DA and SA were significantly higher compared to students showing SAA in their 3rd semester (post hoc Tukey's test, $P = 0.003$), while LAs and academic performance of the students were found comparable in their 5th semester ($P = 0.99$) [Table 4].

DISCUSSION

Results of our study showed almost similar learning preferences among 2nd-year medical students in their 3rd semester. In the multi-modal category, quadrimodal preference was the preference for the majority of students. It is simply because human being uses all of his/her modalities to learn, especially in medical education wherein students have to remember as

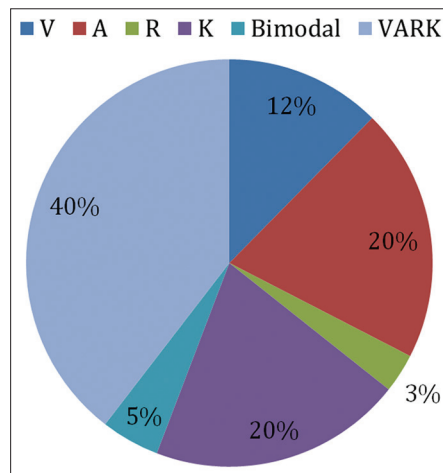


Figure 1: Distribution of students of 3rd semester according to learning styles. V-visual, A- auditory, R- read/write, K- kinesthetic

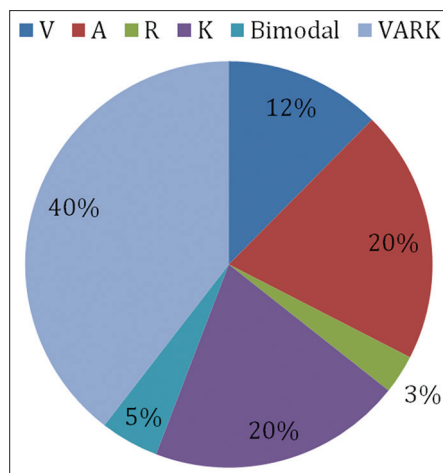


Figure 2: Distribution of students of 5th semester according to learning styles. V-visual, A- auditory, R- read/write, K- kinesthetic

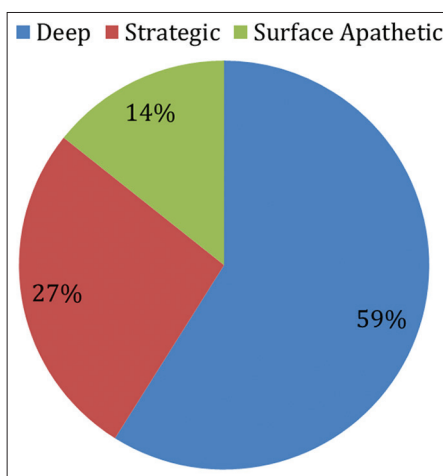


Figure 3: Distribution of students of 3rd semester according to learning approaches

well as conceptualize the information gained. He/she uses the multi-modal method to absorb as much information as he/she can.^[10] These students may be either context specific learners, who switch from one mode to another mode depending on

what they are studying, or are not satisfied until they have had appropriate input from all their preferred modes.^[3] Several studies show that Indian medical students preferred multi-modal learning preferences. A study by Mukherjee *et al.*^[11] showed that 84.21% students preferred multi-modal learning. Studies conducted by Ranganath *et al.*^[12] and Reddy *et al.*,^[13] respectively, showed that 61% and 51.07% Indian medical students preferred multi-modal learning. A study conducted by Urval *et al.*,^[14] carried out on 415 Indian medical undergraduate students showed that majority of students had multi-modal learning preferences (68.7%). Another study by Nuzhat *et al.*,^[15] carried out on medical undergraduates in Saudi Arabia, showed multi-modal learning preferences in 63%. Our study did record multi-modal preferences, but it was not as high as seen in these studies [Table 1].

In our study, unimodal learning preferences (55%) were found to be dominant among 2nd-year medical students in 5th semester. Of the unimodal learners, majority of the students preferred auditory style. One of the reasons for preferring auditory style could be attributed to students learning through didactic lectures in their secondary and higher secondary education. In addition, the current teaching-learning method consisted of 110 lectures resulting in students preferring auditory style. The study conducted by Urval *et al.*^[14] showed that among the unimodal learning

preferences, the predominant unimodal learning preference was aural (45.5%). In addition, a study by Nuzhat *et al.*^[15] showed that the aural learning preference was the most preferred mode of learning in the unimodal category.

In this study, between the male and female medical students, there were some differences in LS preferences; however, these differences were not statistically significant. In 3rd semester, male and female students showed almost similar LSs, namely, quadrimodal followed by auditory style. In 5th semester, similar pattern was followed, but male students showed a preference for kinesthetic LS as compared to 3rd semester. Similar findings are documented in other studies too. In a study by Agnihotri *et al.*^[16] carried in 208 medical undergraduates in Mauritius, there was no difference in learning preferences between the genders. Both males and females preferred a multi-modal learning preference. In another study by Pour *et al.*,^[17] carried out on 360 students of medical sciences, there was no significant relationship between LS and gender. The most preferred LS by both the genders was the read/write LS. In addition, similar results were found in a study by Sinha *et al.*^[18] In this study, majority of males preferred a multi-modal LS, and the majority of female students preferred a single mode of LS (auditory style). In our study, preference for kinesthetic style was observed in 5th-semester students because they had completed their practical program and 2nd-year clinical postings. Due to this their drug prescription, experiences were increased. This could have led to increase in this preference.

In our study, no relationship between LS preference and academic performance was found. Only a few studies have tried to find out the relationship between academic performance and LS trend using VARK questionnaire. There is no established trend regarding LS preference and academic performance. In a study by Almigbal,^[19] on 600 students in Saudi Arabia, there was no relationship between LS preference and academic performance. Similarly, a study conducted in India by Urval *et al.*,^[14] among undergraduate medical students found no statistical significant association between LS preferences and academic performance. In addition, the study by Arbabisarjou, *et al.*,^[20] which involved 220 students from Zahedan University of Medical Sciences

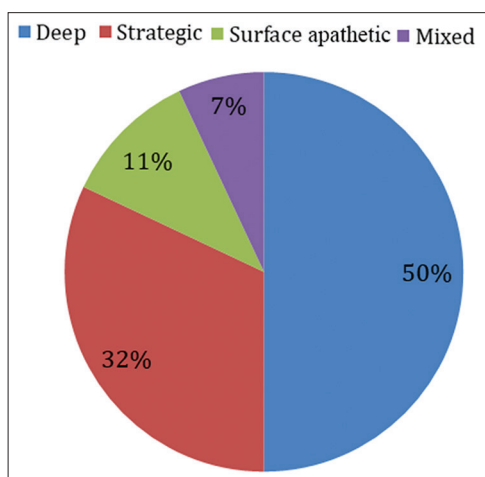


Figure 4: Distribution of students of 5th semester according to learning approaches

Table 1: Gender wise distribution of LSs in students

| LS | 3 rd semester n=112 (%) | | | 5 th semester n=129 (%) | | |
|-------------|------------------------------------|------------|------------|------------------------------------|------------|------------|
| | Total | Male | Female | Total | Male | Female |
| V | 18 (16.07) | 11 (9.82) | 7 (6.25) | 16 (12.40) | 8 (6.20) | 8 (6.20) |
| A | 23 (20.53) | 14 (12.5) | 9 (8.03) | 26 (20.15) | 17 (13.17) | 9 (6.97) |
| R | 4 (3.57) | 1 (0.89) | 3 (2.67) | 4 (3.10) | 2 (1.55) | 2 (1.55) |
| K | 10 (8.92) | 6 (5.35) | 4 (3.57) | 26 (20.15) | 17 (13.17) | 9 (6.97) |
| Bimodal | 5 (4.45) | 4 (3.57) | 1 (0.89) | 6 (4.65) | 3 (2.32) | 3 (2.32) |
| Quadrimodal | 52 (46.42) | 29 (25.89) | 23 (20.53) | 51 (39.53) | 24 (18.60) | 27 (20.93) |

LSs: Learning styles

showed no significant relationship between LSs and academic performance.

In our study, the ASSIST questionnaire was used to identify the preferred LA adopted by undergraduate medical students studying pharmacology. The number of students having SA had increased in the 5th semester as compared to 3rd semester. Some students had showed mixed approach to learning because students in the 5th semester have identified that certain topics require in-depth and strategic reading compared to other topics which require surface learning. The data indicate that the preferred LA was the DA followed by strategic, surface and mixed approach among 2nd-year medical students (Both male and female gender) in their 3rd semester and 5th semester of 2nd-year MBBS. During 3rd semester, there was a significant difference in the performance of the students having deep and SA as compared to students having surface approach. Authors feel that students had understood the importance of pharmacology as subject. They need to apply this knowledge in clinical practice; hence, the LAs should be deep and strategic. There was no significant difference in performance of the students having deep and SA as compared to students having surface and mixed approach in 5th semester. The reason for this could be better understanding of the students in solving the exam papers and their motivation to score. However, in a study by Liew *et al.*,^[21] carried out in 419 pre-clinical medical undergraduates in Malaysia, showed that students with deep/SAs did not contribute significantly toward the learning outcomes in summative examinations. The academic performance recorded in our study was for

formative assessment and may differ from summative assessment. Gender differences were also examined and no significant difference was found between genders.

Knowledge of the preferred LSs and approaches can be useful to both teachers and students so that teachers can tailor pedagogy to correlate with the LSs of students. Similarly, students with knowledge of their LSs and approaches could be empowered to identify and use the techniques of learning best suited to their individual styles, resulting in greater educational satisfaction. The teaching and learning strategies should be redesigned to promote deep/strategic learning among undergraduate medical students. The teaching and learning instructions should be tailored according to the LSs/approaches of the students. More active hands-on learning strategies such as simulations, role-playing, problem-based discussions, and debates should to be incorporated into the teaching and learning activities. This would create better learning environment for the kinesthetic learners.^[21] The authors recommend that learning preferences have to be taken in account during the entry of the students in the 2nd MBBS and plan the teaching-learning program according to plan.

CONCLUSION

Majority of medical students who participated in this study were found to have quadrimodal and auditory learning preferences in pharmacology throughout the semesters. The most common single learning preference was auditory. Majority of the students in 3rd semester and 5th semester used deep and strategic LA. In a 3rd semester, students with deep and SA performed better as compared to students using surface approach. There was no significant comparison between gender, academic performance, and learning preferences.

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Table 2: Academic performance of 2nd MBBS students in pharmacology for different LSs

| LS | 3 rd semester | 5 th semester*Mean (SD) |
|-------------|--|------------------------------------|
| | Mean (SD) % of marks (out of 90 marks) | % of marks (out of 120 marks) |
| V | 47.93 (14.02) | 56.17 (12.78) |
| A | 54.77 (12.42) | 56.30 (11.37) |
| R | 56.67 (9.06) | 51.25 (15.49) |
| K | 49.64 (17.23) | 54.44 (11.08) |
| Bimodal | 29.04 (8.96) | 54.38 (8.64) |
| Quadrimodal | 51.57 (13.26) | 53.61 (9.31) |

SD: Standard deviation, LSs: Learning styles

Table 3: Gender wise distribution of LAs

| LAs | 3 rd semester n=112 (%) | | | 5 th semester n=129 (%) | | |
|-----------|------------------------------------|------------|------------|------------------------------------|------------|------------|
| | Total | Male | Female | Total | Male | Female |
| Deep | 66 (58.92) | 37 (33.03) | 29 (25.89) | 65 (50.38) | 34 (26.35) | 31 (24.09) |
| Strategic | 30 (26.78) | 18 (16.07) | 12 (10.71) | 41 (31.78) | 22 (17.05) | 19 (14.72) |
| Surface | 16 (14.28) | 10 (8.92) | 6 (5.35) | 14 (10.85) | 8 (6.20) | 6 (4.65) |
| Mixed | - | - | - | 9 (6.97) | 7 (5.42) | 2 (1.55) |

Table 4: Academic Pharmacology performance of 2nd MBBS according to LAs

| LAs | 3 rd semester Mean (SD) % of marks (out of 90 marks) | 5 th semester Mean (SD) % of marks (out of 120 marks) |
|-----------|--|---|
| Deep | 52.20 (14.16)* | 54.69 (10.21) |
| Strategic | 53.15 (13.31)* | 54.40 (10.18) |
| Surface | 40.06 (9.67) | 54.82 (13.72) |
| Mixed | - | 55.14 (11.37) |

* $P < 0.05$ using *Post hoc* Tukey's test. SD: Standard deviation

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