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Original Research Article

Assessment of learning styles using VARK model in first year undergraduate medical students

Nisha Kurian¹, Vikram Gowda N R^{2,*}¹Dept. of Community Medicine, Pushpagiri Institute of Medical Sciences & Research Center, Tiruvalla, Kerala, India²Dept. of Physiology, Pushpagiri Institute of Medical Sciences & Research Center, Tiruvalla, Kerala, India

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ABSTRACT

Background: In the assimilation and processing of information, students favor different choices. Fleming described the VARK learning style model that includes a questionnaire which enables us to recognize a person's sensory modality preference in learning. It categorizes the learning styles into four: visual (V), aural (A), read/write (R), and kinesthetic (K).

Objectives: 1) To assess the learning styles of first year MBBS students of a Private Medical College in Kerala and find out prevalence of unimodal and multimodal learners. 2) To find association between scores of students in anatomy, biochemistry and physiology and their VARK categories. 3) To determine the association between gender and VARK categories.

Materials and Methods: A cross-sectional self-administered questionnaire survey was conducted among first year undergraduate medical students in a private medical college in Kerala. VARK questionnaire, consists of 16 multiple choice questions, was distributed to the participants after obtaining written consent. Scores of their internal assessment were also collected. The data was analyzed and the learning styles were presented as percentages. Chi-square test, Mann-Whitney U test, and Kruskal-Wallis tests were used to find the association between learning styles and gender, and the scores in internal assessment.

Results: The total number of students enrolled for the study was 100. Age ranged from 17 to 22 years and females constituted 62%. It was observed that 84% students were unimodal, out of which Kinesthetic (45.2%) was the most preferred. There were 12 bimodal and 4 trimodal learners. No association between learning styles and gender as well as between learning styles and academic performance based on written and practical exams of Anatomy, Physiology and Biochemistry were found. We found there were notable differences between males and females in unimodal kinesthetic and auditory learners in certain scores.

Conclusion: The present study reported that unimodal learners were more frequent than bimodal and trimodal learners. There were no quadrimodal learners. The preferred method of learning amongst unimodal learners was the kinesthetic style. We found no association between gender and the preferred learning style. The study also found that there was no association between academic performance (scores) and their learning styles.

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1. Introduction

University students vary in their socio-economic background, the age of the students, the cultural backgrounds, previous educational experiences, levels

of competency and preparedness, and their choice of methods of learning.¹ Teaching effectively in such an environment is challenging. Teaching is defined as the presentation of knowledge. Learning, however, is multi-factorial and relies on the mentality of the individual student.²

* Corresponding author.

E-mail address: vikramgowda2@gmail.com (V. Gowda N R).

There are various productive components involved in the learning process. They include the student's motivation and interest in the subject, their level of competency and proficiency, engagement and active involvement in the teaching-learning process, affective domain of the student (personality, curiosity, prior knowledge of the subject, emotional status, boredom, motivation, concern, and an incentive to study, if any,) and choice of learning method.³

Learning style inventories are models that help us determine the student's style of intellectual approach in assimilating and processing information.⁴

Neil Fleming brought forward the VARK learning style method in 2006.⁵ It categorizes students into four different learning styles. Each style is based on the choice of senses used to gather information. They are visual (V), aural (A), read/write (R), and kinesthetic (K). The VARK inventory has a questionnaire that recognizes an individual's sensory modality preference.

Visual learners (V) use image intense figures, graphics and videos to learn. They prefer to use printed information in the form of symbolic tools like arrows, flowcharts, graphs, models and hierarchies. This kind of learners teach others by drawing diagrams.⁶

Aural learners (A) pay attention to the words spoken by their teachers.² They like to listen rather than write elaborate lecture notes. They also prefer discussions, seminars and listening to recordings of the lectures.³ Aural learners can also retain information by reading aloud and by quietly mouthing when reading.⁷

Read/Write learners (R) prefer to obtain information from reading printed texts. They choose using lecture notes/hand-outs and textbooks and are observant note-takers.²

The kinesthetic learners (K) choose hands on experience, practical application and use of models. They prefer to use touch, movement and interact with their learning environment.² They do not prefer the method of just listening even if there are visual aids. This kind of students are passive in the classroom.

In the critical article "I'm different; not dumb: Modes of presentation (V.A.R.K.) in the tertiary classroom", written by Fleming, he states the people learn by using various methods to convert the educational information into their long-term memories.⁸

If educators are aware of the different learning styles, they can identify and solve the learning problems amongst students.⁹ This study was executed with the objectives of determining the preferred learning style of first year undergraduate medical students using the VARK questionnaire, the association between learning preference and their academic performance using their internal assessment scores, and gender.

2. Material and Methods

The present cross-sectional study was conducted among first year MBBS students of one private medical institution in Kerala, South India. After approval from the authorities, a suitable class period was selected for scheduling the conduct of the study. We used a self-administered questionnaire V7.1⁵ to collect data. After explaining the purpose of the study and obtaining a written informed consent, we distributed the questionnaires to the participants.

Internal marks (scores) of the students were obtained from the college authorities. All students (n=100) participated in the study.

The information obtained was entered into excel sheet and analyzed. The learning preferences among participants were expressed as percentage and percent scores (internal marks) were described as median and range. Chi-square test was used to find association of learning styles with gender. Kruskal-Wallis ANOVA was used to test difference in median scores (%) between learning styles for each subject (anatomy, physiology and biochemistry; theory and practical) and Mann-Whitney U test for comparison of scores for each subject according to gender for each learning styles. A p value of <0.05 was considered as statistically significant.

3. Results

Age of the participants ranged from 17 to 22 years with a mean (SD) of 19.55 (0.94) years and 62% were females. The age and gender distribution is given in Table 1.

Table 1: Percentage distribution of study participants by age and gender

Age in years	Gender		Total
	Male	Female	
< 20	16	30	46
≥ 20	22	32	54
Total	38	62	100

Figure 1 shows the pattern of learning styles of the participants. Majority of them (84%) were unimodal. Among the 14% who were multimodal, majority were bimodal.

Kinesthetic and Aural were more prevalent among the learning styles of the participants. Statistics of learning styles in each modal is presented in Table 2.

Table 3 gives details regarding percent scores of all participants in Anatomy, Physiology and Biochemistry, both theory and practical examinations.

The median scores (%) for each subject according learning styles are given in Table 4. The difference in median scores (%) between learning styles was not statistically significant.

The highest preference among females was auditory mode (40.3%) and it was kinesthetic mode (36.8%) among

Table 2: Learning styles of study participants

Learning style	No. of participants	Percent
Unimodal (n=84):		
Kinesthetic (K)	38	45.2
Aural (A)	37	44.1
Visual (V)	7	8.3
Read/write (R)	2	2.4
Bimodal (n=12):		
AK	9	75.0
RK	1	8.3
VA	2	16.7
Trimodal (n=4):		
ARK	1	25.0
VAK	1	25.0
VAR	2	50.0

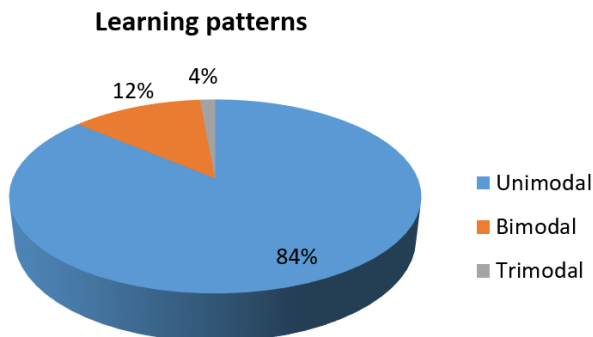
Table 3: Descriptive statistics of assessment scores (%)

Subject	Median	Min.-Max.
Anatomy		
Theory	48.0	23.5-74.0
Practical	67.5	38.0-85.0
Physiology		
Theory	48.2	17.0-69.5
Practical	61.7	41.7-75.8
Biochemistr		
Theory	49.0	19.5-75.5
Practical	72.4	46.7-83.8

Table 4: Median score (%) according to VARK style

Subjects		Unimodal (n=84)				Multimodal (n=16)		P Value
		V (n=7)	A (n=37)	R (n=2)	K (n=38)	BM (n=12)	TM (n=4)	
Anatomy	T	38.5	48.0	9.3	50.5	48.2	45.0	0.857
	P	52.3	66.7	69.3	68.3	68.8	66.7	0.99
Physiology	T	41.0	49.0	45.2	48.2	52.5	49.5	0.857
	P	56.7	61.7	61.2	62.1	62.9	65.8	0.99
Biochemistry	T	41.5	53.0	43.5	47.5	51.2	52.5	0.857
	P	66.7	74.2	71.9	69.5	73.8	70.0	0.99

T – Theory, P-Practical, BM-bimodal, TM-trimodal

**Fig. 1:** Learning patterns

males. The association between gender and learning styles of the students is presented in Table 5 and it was not significant ($p=0.187$).

Median marks according to gender for kinesthetic learners are given in Table 6. There is significant difference in the median marks (%) between male and female students in Physiology Theory and Biochemistry Theory among these learners. No significant difference was found in other subjects.

Median marks according to gender for auditory learners are shown in Table 7. The difference in the median marks (%) between males and females was significant for auditory learners for Anatomy theory and practical, physiology practical and biochemistry practical.

No significant difference was found in the scores of any subjects between males and females in the visual,

Table 5: Pattern of learning styles by gender

Style	Gender		Total
	Male	Female	
Visual	5(13.2%)	2 (3.2%)	7
Aural	12 (31.6%)	25 (40.3%)	37
Read/write	0	2 (3.2%)	2
Kinesthetic	14(36.8%)	24 (38.7%)	38
Bimodal	4(10.5%)	8 (12.9%)	12
Trimodal	3(7.9%)	1 (1.6%)	4
Total	38	62	100

p=0.187

Table 6: Distribution of Median marks (%) according to gender for kinesthetic learners

Gender	Anatomy		Physiology		Biochemistry	
	Theory	Practical	Theory	Practical	Theory	Practical
Male	38.8	66.5	42.3	60.0	41.5	65.7
Female	51.3	69.7	51.0	62.5	52.8	70.0
P value	.054	.180	.043	.260	.034	.191

Table 7: Distribution of Median marks (%) according to gender for auditory learners

Gender	Anatomy		Physiology		Biochemistry	
	Theory	Practical	Theory	Practical	Theory	Practical
Male	41.0	59.7	40.0	55.4	44.8	68.6
Female	51.5	71.0	51.5	64.2	53.0	75.2
P value	.005	.001	.057	.041	.109	.008

read/write, bimodal or trimodal learning styles.

4. Discussion

In our present cross sectional study done in Kerala, majority (84%) of the participants had unimodal learning style, with the highest unimodal preference as kinesthetic (K) (45.2%). A similar study conducted by Liew et al¹⁰ among randomly selected 419 preclinical undergraduate medical students of Kuala Lumpur found that 81.9% were unimodal learners of which kinesthetic (K) type were more common (30.1%), which is exactly in line with our study results. They identified that amongst the middle and high achievers in summative examinations, most of them had kinesthetic (unimodal) style of learning (30.5%), whereas no significant association between scores in internal assessment and learning style was found in the present study.

Studies conducted in Vellore¹¹ and Colombo¹² showed that majority of participants had multimodal learning styles (86.8% in Vellore and 69.9% in Colombo), in contrast to the present study. The highest unimodal preference was kinesthetic (7.7%) in Vellore and auditory learners (50%) in Colombo. In both studies, the commonest learning preference was the bimodal style, of which the highest percentage was seen in the AK and AR category. In the present study 12% were bimodal learners and the commonest style among them was AK (75%).

Al Qahtani et al¹³ in their study among undergraduate dental students found that the majority of participants preferred multi-modal learning and they identified a notable difference between genders when comparing learning styles. The unimodal style was favored by males while females preferred almost equally the bimodal and quadrimodal methods. However, in our present study, we found no significant difference in learning styles between males and females.

Multimodal learners had higher cumulative grade point average (GPA) when compared with the unimodal learners among medical students in Saudi Arabia¹⁴ whereas findings by Farkas et al¹⁵ suggest that not learning preferences, but specific career goals and study time are associated with better performance in a combined undergraduate Anatomy and Physiology course. No association was found between academic performance (assessed by marks) and VARK model of the students, in the present study. This might be due to irregular approach towards academics where the students end up learning most of the syllabus on the day before the test and hence cannot use effective methods synonymous with their VARK preference.

5. Conclusion

This study found that there were only 4% trimodal and none were quadrimodal learners. Among the kinesthetic (K) learners, significant difference was seen in the marks

between males and females in the theory papers of Physiology and Biochemistry whereas among auditory (A) learners, the difference was significant between all exams except for the theory papers of the above subjects. Apart from these results, the difference between genders in the marks of any subjects according to learning style preferences was not significant.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Author biography

Nisha Kurian, Assistant Professor

Vikram Gowda N R, Professor and HOD

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