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A study on learning preferences of undergraduate medical students in Kolkata

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Abstract
Introduction: Neil Fleming created the VARK survey to assess learning style preferences which provides the learners with a profile of their learning styles.
VARK is an acronym for the Visual (V), Auditory/Aural (A), Read &Write (R) and the Kinaesthetic (K) sensory modalities.
Objectives: To understand the preferred sensory modality (or modalities) of students for learning style
Methods: A descriptive cross-sectional study was carried out among 392 First, second and third professional undergraduate medical students in a teaching hospital of Kolkata from April 20' 2015 to May19'2015.
Analysis: Statistical Package for the Social Sciences Version 23.0 & Epi-info 6.04d.
Results: About 59.69% students had multimodal learning style preferences and 40.31% had unimodal preferences; the most common VARK mode distribution was unimodal (40.31%); followed by quadrimodal (27.04%), trimodal (17.34%), & bimodal (15.31%); among the unimodal group, aural/auditory mode (44.30%) was the most preferred mode; amongst those who preferred bimodality, 33.33% preferred aural & kinaesthetic (AK);for those students that preferred three modes of information presentation, 41.18% preferred combination of aural, read/write & kinaesthetic (ARK).
Conclusions: We hope these data will help us better our course contents and make learning a more fruitful experience.

Keywords: VARK, medical students, learning preference

Introduction

As of October 2016, there are approximate 2,980 recognized and operating medical schools in 179 countries or territories listed in the International Medical Education Directory (IMED) [1]; about 462 are in India and 18 are in West Bengal with an approximate number of 63,535 and 2700 medical students are graduating annually in India and West Bengal respectively as per Medical Council of India (MCI). [2]

According to the U.S. Department of Education's 2005 "Condition of Education" report; medical colleges and universities are experiencing a significant growth in student enrolment; with class sizes are reaching unprecedented levels. As a result, the medical educators face the unique challenges of teaching larger classes while maintaining and improving the quality & value of medical education. [3] Currently didactic lectures are the method of choice to get across a large amount of theoretical information to a large group of learners at one time. Well organized lecture remains one of the most effective ways to integrate and organize information from multiple sources on complex topics. [4] Lectures are frequently supported by audio visual aids by highlighting key points on a white board or black board, the projection of printed or written matter on transparencies via an overhead projector (OHP) or via a computer based system; called Microsoft power point application. [5]

Teaching in most Asian countries is dominated by teacher-centred class rooms. [6] Concepts such as flexibility in learning, problem solving, critical thinking and independent learning are least recognized. [6, 7] The emerging trend globally is to have a problem-based, integrated student- centred medical curriculum, which demands active participation from the students and facilitates self-directed learning. [8]

Having knowledge on the learning styles of learner's is a vastly underutilized approach towards an improvement in the classroom instructions. [9]

Educational researchers postulate that everyone has a learning style and, if instruction is adapted to accommodate that style, it is anticipated that improved learning will result. [10]

Developing knowledge of different learning styles among the student population is important during designing curricula; to promote student learning and develop the deep learning skills needed for lifelong. The learning style information can benefit the students as it help them in formulating their appropriate learning strategies to enhance their learning. [11]There seems lack of consensus as to the best teaching and learning methods for medical students. [12]It is well known that no system could be fool proof in its application; it must be modified and applied to suit the needs of students in a particular infrastructure. [13]

New Zealand educator Neil Fleming created the VARK survey in 1998 to assess learning style preferences which provides the

learners with a profile of their learning styles, based on the sensory modalities which are involved in taking information [14] The instruments are simple, quick and easy for students to use and understand. VARK is an acronym for the Visual (V), Auditory/Aural (A), Read &Write (R) and the Kinaesthetic (K) sensory modalities. VARK model was used in the present study as it addresses learning styles that was open for self modification and it is also accompanied by study strategies for each style. [11]

With this background, the present study was conducted to understand the preferred sensory modality (or modalities) of students for learning style using VARK questionnaire.

Materials and Methods

Type of study – An institution based observational descriptive study.

Study design – Cross sectional.

Study area – A tertiary care teaching hospital of Kolkata.

Study population-First, second and third professional (part-1) undergraduate medical students.

Inclusion criteria: who were present during the days of data collection and gave informed written consent to participate in the study.

Exclusion criteria: third professional (part-II) undergraduate medical students.

Study duration & study period – 30 days, from April 20' 2015 to May19'2015.

Sample size – Considering the preference for lectures as an effective method of teaching at 50%, an absolute precision of 10%, and confidence interval of 95% the sample size of 400 was calculated. The final sample of 440 was obtained assuming a non-response rate of 10%.

Sampling technique –Non Probability Purposive Sampling.

Study tools- A Pre-designed, Pre-tested structured self administered questionnaire; VARK Model questionnaire version 7.1.

Study variables: Age, gender, religion, type of family, day scholar/hostel resident, year of
study, per capita monthly income (PCMI), preference of VARK sensory modality (s).

Study technique: Self administration of VARK questionnaire

Methods of data collection

Data collection was done for each professional separately. Before filling the questionnaire, the study population were explained about the purpose and nature of the study; their anonymity & confidentiality were ensured; then their informed written consent were taken; and questionnaire were administered to get filled by themselves completely and truthfully.

Data analysis

Data were entered in Microsoft Office Excel 2010 (Microsoft Corp, Redmond, WA, USA), and analyzed with Statistical Package for the Social Sciences Version 23.0 for the Windows platform (SPSS Inc., Chicago, IL, USA)& Epi-info 6.04d (Centres for Disease Control and Prevention, Atlanta, GA, USA, 2001) and analyzed using percentages and suitable diagrams.

The questionnaire were scored to describe the distribution of VARK preferences. Preference rankings were calculated by totaling all a responses (visual), all B responses (aural), all C responses (read/write), and all D responses (kinesthetic); and dominant preference was determined by which category received the most responses.

Operational definitions:

1. **Residence**
   a) Hostel: - Rooms allotted by the college for accommodation.
   b) Day Scholar: - Students with their own accommodation.
2. **Types of family [15]**
   a) Nuclear Family: It consists of a married couple and their dependent children.
   b) Joint Family: It consists of a number of married couples and their children living together in the same household. All the property is held in common and all the authority is usually vested in a senior male member of the family.
3. **Per Capita Monthly Income (PCMI): As per Modified B. G. Prasad Scale 2015:-** [16]
   a) Class I (upper): Rs.5, 615 and above.
   b) Class II (upper middle): Rs.2,808 – Rs.5,614
   c) Class III (lower middle): Rs.1,685 – Rs.2,807
   d) Class IV (upper lower): Rs.842 – Rs.1,684
   e) Class V (lower): Below Rs.842

D.VARK [14]

VARK is a questionnaire that provides users with a profile of their learning preferences. These preferences are about the ways that they want to take-in and give-out information.

VARK Modalities

The acronym VARK stands for Visual, Aural, Read/write, and Kinesthetic sensory modalities that are used for learning information. Fleming and Mills (1992) suggested four modalities that seemed to reflect the experiences of the students and teachers. Although there is some overlap between them they are defined as follows:

- **Visual (V):** This preference includes the depiction of information in maps, spider diagrams, charts, graphs, flow charts, labeled diagrams, and all the symbolic arrows, circles, hierarchies and other devices, that people use to represent what could have been presented in words. It does NOT include still pictures or photographs of reality, movies, videos or PowerPoint.
- **Aural / Auditory (A):** This perceptual mode describes a preference for information that is *"heard or spoken.*" Learners who have this as their main preference report that they learn best from lectures, group discussion, radio, email, using mobile phones, speaking, web-chat and talking things through. Email is included here because; although it is text and could be included in the Read/write category (below), it is often written in chat-style with abbreviations, colloquial terms, and non-formal language.
- **Read/write (R):** This preference emphasizes text-based input and output – reading and writing in all its forms but especially manuals, reports, essays and assignments. People who prefer this modality are often addicted to PowerPoint, the Internet, diaries, dictionaries, quotations and words, words, words… Note that most PowerPoint presentations and the Internet, GOOGLE and Wikipedia are essentially suited to those with this preference as there is seldom an auditory channel or a presentation that uses Visual symbols.

- **Kinesthetic (K):** It includes demonstrations, simulations, videos and movies of *"real"* things, as well as case studies, practice and applications.
- **Multimodality (MM)**:- VARK questionnaire provides four scores and also there are mixtures of those four modes. Those who do not have a standout mode with one preference score well above other scores, are defined as multimodal.
- **VARK Questionnaire**: - It consists of 16 questions with 4 options for each. Each option correlates to a particular sensory modality preference. The questions describe situations of common occurrence in daily life. Students were instructed to choose the answer that best explained their preference and circle the letter (s) next to it. They could choose more than one option or leave blank any question that they felt was not applicable to them.

Results

A total of 392 undergraduate medical students participated and answered the 16 questions. Thus the overall response rate was 89.09%. Their age ranged between 17 to 26 years; with mean age and standard deviation was 21 years and 0.75 years respectively; 31.63% were between 21-22 years age group; 53.06% were males & rest 46.94% were females; 88.26% were Hindus by religion; 55.10% were hostel residents; 68.37% belonged to nuclear family; 52% read in 2nd year; and 70.92% belonged to class I as per modified BG Prasad Scale March 2015 (Table 1).

Table 2 demonstrated distribution of the study population according to their preferred method of sensory modality for learning. Student preferences for how they receive information can be singular, two modes, three modes or all four modes of presentation. It was found that 59.69% students had multimodal learning style preferences and 40.31% had unimodal preferences [Figure 1].

Taking unimodal and multimodal together for consideration as 100%; the most common VARK mode distribution among students was unimodal (40.31%); followed by quadrimodal (27.04%), trimodal (17.34%), & bimodal (15.31%) [Table 2]; [Figure 2].

It was seen from Figure 3 that in the multimodal group; majority preferred quadrimodal learning styles; followed by trimodal and bimodal respectively (45.30%; 29.06% & 25.64% respectively).

Table 3 demonstrated distribution of unimodal learning style preferences. In this study, we observed that 40.31% of the students showed an unimodal learning style preference. Among the unimodal group, 13.92% were visual learners (V), 44.30% were auditory learners (A), 25.32% were read-write (R) learners and 16.46% were kinaesthetic learners (K). The aural/auditory mode (44.30%) was the most preferred mode and the visual mode (13.92%) was the least preferred mode [Figure 4].

Table 4 revealed distribution of the study population according to their most preferred multimodal learning methodology. Amongst those who preferred bimodality, 33.33% preferred aural & kinaesthetic (AK), followed by audio with read/write (AR) presentation (30%), read/write & kinaesthetic (RK) (13.33%), visual & kinaesthetic (VK) (10%) and 6.67% preferred both visual & audio (VA) and audio and kinesthetic (VR) [Figure 5].

For those students that preferred three modes of information presentation, 41.18% preferred combination of aural, read/write & kinaesthetic (ARK), 29.41% preferred the combination of visual, aural &kinesthetic (VAK), 20.59% visual, aural & read/write (VAR) and only 8.82% & visual, read/write & kinesthetic (VRK) [Figure 6].

Tables and Figures

Table 1: Distribution of the study population according to socio demographic variables (N=392)

Variables		Number (n)	Percentage (%)
Age (in years)	17-18	92	23.46
	19-20	90	22.95
	21-22	124	31.63
	23-24	58	14.79
	25-26	28	07.17
Gender	Male	208	53.06
	Female	184	46.94
Religion	Hindu	346	88.26
	Muslim	46	11.74
Residence	Day Scholar	176	44.90
	Hostel Residence	216	55.10
Type of family	Nuclear	268	68.37
	Joint	124	31.63
Year of study	1st	176	44.9
	2nd	204	52.0
	3rd	12	03.1
Per Capita Monthly Income (PCMI)	Class I	278	70.92
	Class II	76	19.39
	Class III	24	06.12
	Class IV	08	02.04
	Class V	06	01.53
Total		392	100.00

Table 2: Distribution of the study population according to their preferred method of learning style (N=392)

Modality	Number (n)	Percentage (%)
Unimodality	158	40.31
Multimodality	234	59.69
Bimodality	60	15.31
Tri-modality	68	17.34
Quadri-modality	106	27.04
Total	**392**	**100.00**

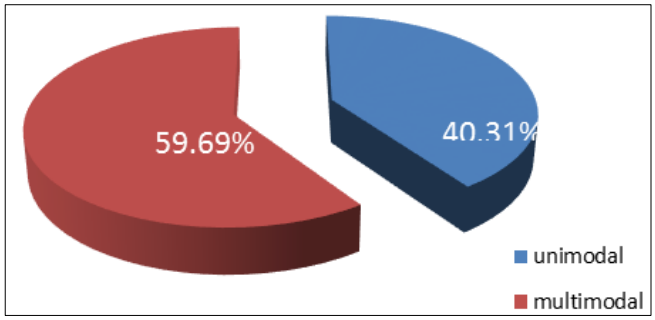


Fig 1: Pie diagram showing overall distribution of learning styles (N=392)

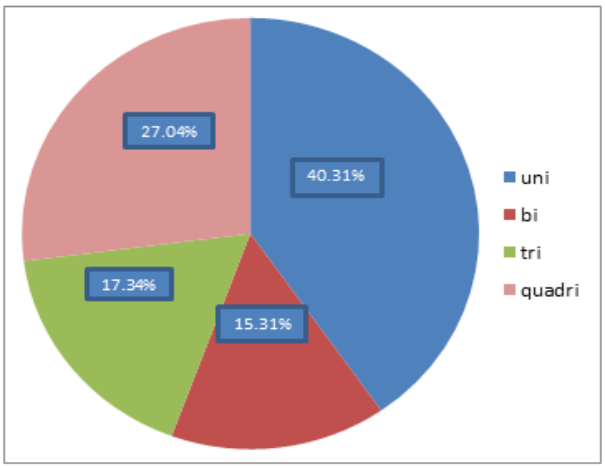


Fig 2: Pie diagram showing percentages of students who preferred one (unimodal), two (bimodal), three (trimodal), and four (quadrimodal) modes of information (N=392)

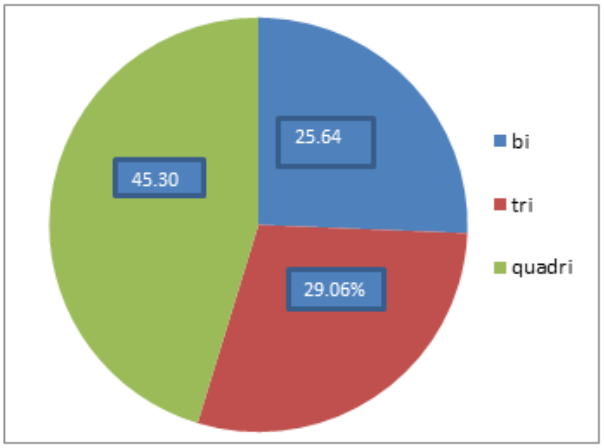


Fig 3: Pie diagram showing percentages of students who preferred multimodal modes of information (N=392)

Table 3: Distribution of the study population according to their most preferred unimodal learning methodology (N=158)

Unimodal Methods	Number (n)	Percentage (%)
Visual	22	**13.92**
Aural/Auditory	70	**44.30**
Read/Write	40	25.32
Kinesthetic	26	16.46
Total	**158**	**100.00**

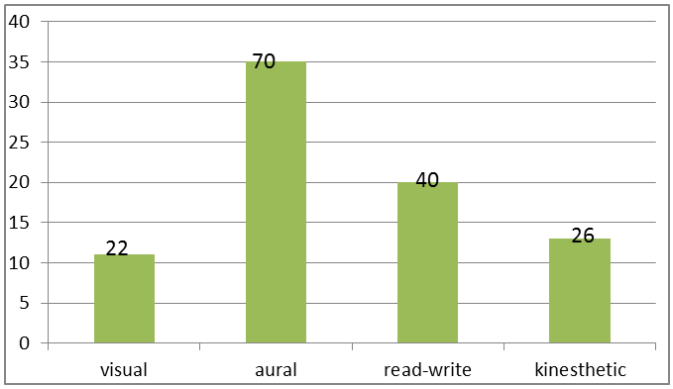
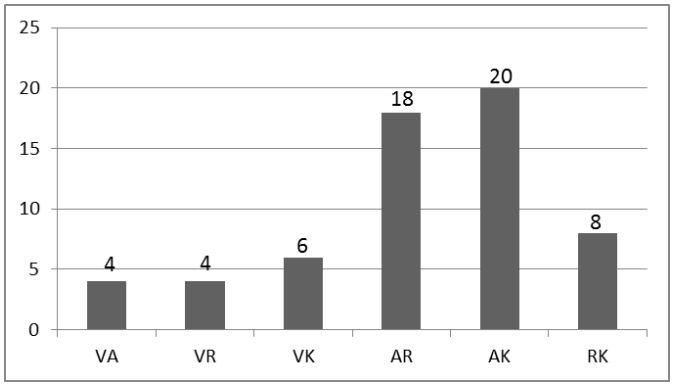


Fig 4: Bar diagram showing distribution of unimodal learning styles (N=158)

Table 4: VARK mode distribution among bimodal and trimodal group (N=128) V, visual; A, aural; R, reading/writing; K, kinesthetic

Multimodal Methods	Number (n)	Percentage (%)
Bimodal (n=60)		
VA	04	06.67
VR	04	06.67
VK	06	10.00
AR	18	30.00
AK	20	33.33
RK	08	13.33
Trimodal (n=68)		
VAR	14	20.59
VRK	06	08.82
VAK	20	29.41
ARK	28	41.18



V= Visual; A=Aural/Auditory; R=Read-Write; K=Kinesthetic

Fig 5: Bar diagram showing distribution of bimodal learning styles (N=60)

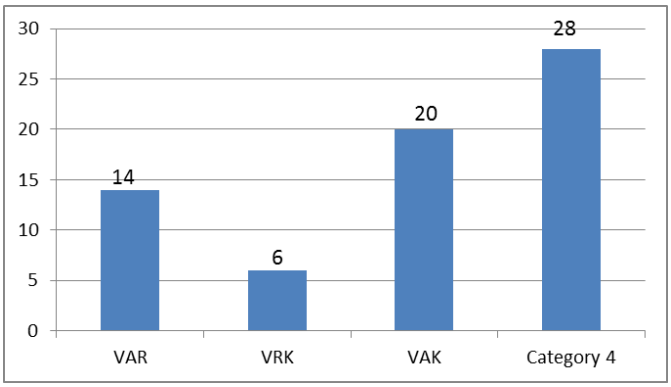


Fig 6: Bar diagram showing distribution of trimodal learning styles (N=68)

Discussion

Knowing the learning style preferences of students is valuable in education because it help educators to identify and solve learning problems among students; thus helping students to become more efficient learners. [17]

The present study used the VARK questionnaire to determine the learning preferences of undergraduate medical students in a medical college of Kolkata. The majority of the students in our study exhibited multiple learning preferences (59.69%). Similar results have been reported by authors from different geographic locations that have used the VARK questionnaire as a learning style. [10, 18, 19, 20, 21, 22].

Urval *et al.* at Kasturba Medical College, Manipal University, Mangalore, Karnataka[18]showed that 68.7% of the medical students preferred multimodal learning style; the corresponding figures were 56% by Murphy *et al.* at Temple University School of Dentistry [10]; 63.9% by Baykan *et al.* at Erciyes University, Kayseri,Turkey among medical students [19]; 63.8% by Lujan *et al.* at Wayne State University School of Medicine, Detroit, Michigan [20]; 58% by Dinakar *et al.* in the caregivers of asthmatic children [21]; and 59.9% by Bahadori *et al.* among health services management students of the medical science universities of Iran [22]. In contrast, it was higher (72.6%) by Nuzhat *et al.* at Saudi Arabia among medical students [23]; (85.7%) by Ding *et al.* in a Chinese Medical School [24]; and (92.98% males & 76.27% females) by Choudhary *et al.* of Govt. Medical College,Kota. [25] However study by Murthy *et al.* at SJM Dental college, Chitradurga, Karnataka among dental students [11] and Kumar *et al.* at AIMST University, Malayasia [26] among medical students revealed that only 26% dental students & 48.6% medical students preferred multimodal learning styles respectively. Teaching-learning in our institution mainly consists of lecture classes using chalk& talk method and PowerPoint presentations. Practical classes are mainly small-group teaching using demonstrations. So multimodal learning may help to some extent in overcoming some of the deficiencies of those methods.

In this study, taking unimodal and multimodal together for consideration as 100%; the most common VARK mode distribution among students was unimodal (40.31%); followed by quadrimodal (27.04%), trimodal (17.34%), & bimodal (15.31%) which was corroborative with the findings in Michigan [20]whereas it was unimodal (36.1%), 4modes (27.71%), 3modes (20.48%), & 2modes (15.66%); on the contrary it was unimodal (74%), bimodal (23%), trimodal (2%)& quadric (1%) in Chitradurga [11]; quadrimodal (36.6%) followed by unimodal (31.3%), bimodal (18.1%), & trimodal (14%) in Mangalore [18]; unimodal (36.1%), bimodal (30.3%), trimodal (20.7%), & quadmodal (12.9%) in Turkey [19]; trimodal (30.9%), unimodal (27.4%), bimodal (25.3%), &quadrimodal (16.4%) in Saudi Arab [23]; and Quadmodal (50.0%), trimodal (19.4%), bimodal (16.3%), & unimodal (14.3%) in China. [24

Among the unimodal group, the aural/auditory mode (A) (44.30%) was the most preferred mode and the visual mode (V) (13.92%)was the least preferred mode in our study; which was in line with the findings by Urval *et al.* [18] (A:45.5% & V:5.4% respectively). However the most preferred mode & the least preferred mode were visual (V) & kinaesthetic (K) by Murphy *et al.* [10]; read/ write (R) (25%) &visual (V) (15%) by Murthy *et al.* [11]; kinaesthetic (K) (23.3%) & read-write (R) (1.9%) by Baykan *et al.* [19]; kinaesthetic (K) (18.1%) &aural (A) (4.8%) by Lujan *et al.* [20]; R-W (18%) & V (3%) by Bahadori *et al.* [22]; aural (A) (11.6%) &read-write (R) (2.1%) by Nuzhat *et al.* [23]; R-W (83.7%) &A (64.3%) by Ding *et al.* [24] and read (R) (38%) & visual (V) (10%) by Kumar *et al.*. [26]

In the multimodal group; majority were quadrimodal followed by trimodal and bimodal (45.30%; 29.06% & 25.64% respectively) compatible with Michigan (quadric, tri, bi) [20] but dissimilar to Chitradurga (bi, tri, quadric) [11]; Mangalore (quadri, bi, tri) [18]; Turkey (bi,tri, quadri) [19]; Saudi Arabia (tri, bi, quadric) [23]; China (quadric, tri, bi) [24]; Kota (tri, bi, quadri) [25] and Malayasia (quadric, bi, tri) [26]

In the present study; of the students who preferred two modes of information presentation, most preferred methods were AK (35.49%) which was in line with Mangalore (30.7%) [18]; Turkey (20.2%) [19]; and Saudi Arabia [23]. In contrast in Chitradurga [11] and in Michigan [20]; most preferred bimodal methods were AR.

In our study; of the students who preferred three modes of information presentation, ARK were the most preferred methods (42.86%); similar to Urval *et al.* [18]; Baykan *et al.* [19]; and Lujan *et al.* [20]. However VRK & VAR were equally preferred in study by Murthy *et al.* [11]; AK were most preferred in study by Nuzhat *et al.* [23]; and by Ding *et al.*. [24]

Like other studies; our study also has some **limitations.** It does not address whether altering the teaching methods according to student learning style preferences improves academic performance. We haven't studied influence of sex and past academic performance on learning style preference. The study is also limited with its small sample size and students were from one single college. For this reason, these findings cannot be generalized to all the medical students.

Conclusions

Most of the students were multimodal learners, which is good from both a teaching as well as learning perspective. Among the multimodal; majority were quadrimodal followed by trimodal and bimodal. Aural was the preferred sensory modalities of learning. We hope these data will help us better our course contents and make learning a more fruitful experience.

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