Preferences in Learning Styles among Undergraduate Students of Various Disciplines of Education from Selected Indian Universities

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Abstract: *Students have different learning styles which can affect the way they learn. In the present scenario, it is vital even for the students to know their own learning style so that they can cope up easily with the learning processes in a comfort zone. Educators have a greater encumbrance to understand the heterogeneity of their students and potentially improve in a variety of ways to accommodate all learners' preferences. The aim of our study was to analyze preferred learning styles among undergraduate students of various disciplines of education. This cross sectional study was conducted in selected Indian universities. Final year students of various disciplines of education who were willing to participate in the study were selected. The demographic details were collected after obtaining their consent for participation. VARK questionnaire was administered to the students in the form of hard copies to analyze their preferred learning styles. Overall, the results revealed that students showed highest preference in kinesthetic learning. Engineering student's least preferred visual learning in comparison to students of other disciplines. Medical students were less interested in aural and read/write learning than others. Kinesthetic learning is preferred more by medical and dental students than engineering students. All findings were statistically significant at p-value<0.05. Therefore, this study will help in revamping the teaching approaches to suit the students' preferences so that they feel comfortable in enhancing their learning performance.*

Key-words: *Learning Styles, VARK questionnaire*

I. Introduction

Recent trends in education acknowledge a change in the learning strategies from pedagogy to andragogy.[1]. Each learner has the capacity to incorporate his/her own appropriate learning style. Many factors influence learning including the educator, student, course/curriculum and the educational environment. Over the years, there has been a gradual shift in medical education from a teacher-centered, passive learning approach to a student-centered, active learning approach.[2]. A teacher should be creating an environment to fulfil the demand of students' various learning styles, as well as knowing the importance of teaching by using various learning styles.[3]. Understanding learning styles and framing teaching strategies accordingly has become a cornerstone of good teaching practice. The knowledge of learning preferences can help teachers to make efforts to address the students by effective teaching strategies. Learning styles also influence the students' academic success and fulfillment of the objectives of teaching.

VARK model which was developed by Fleming is an acronym for visual (V), aural(A), read/write (R) and kinesthetic (K) sensory modalities. Visual learners learn well by seeing by the use of diagrams and symbolic devices, aural learners learn best by hearing through lectures, tutorials or discussion. Read/write learners prefer to use text books, lecture notes and handouts; whereas kinesthetic learners procure information through real practices/experience.[4].Some studies have reported the learning style preferences of medical students and other health sciences.Investigations were also done to check whether association prevail between learning styles and gender, learning styles and academic performance and have provoked mixed findings.[2].

Identifying students as visual, aural, read/write or kinesthetic learners will help in effectively tailoring instructional strategies and methods to cater to those learning needs of the students.[1]. There is a strong need to motivate teachers to move from their preferred mode of teaching to the mode preferred by students which can definitely result in better learning outcomes. Though there are studies available regarding learning

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stylepreferences among students, so far literature reviews comparing it between seven disciplines of education are very scanty.

Hence, in the present study, we planned to evaluate the preferences in learning styles among undergraduate students of various disciplines of education which aims to accommodate individual strength and requirements, in which teachers can develop relevant novel teaching approaches.

II. Material And Methods

This study was conductedamong students studying MBBS, BDS, BPT, BE, B.Sc Nursing, BBA and BALLB in selected universities in Vellore district of Tamil Nadu, India from July 2017 to May 2018. A total 820 students (both male and female) aged between 21 -23 years were in this study.

Study Design: Cross sectional study.

Study Location: This study was conducted in selected universities in Vellore district of Tamil Nadu, India.

Study Duration: July 2017 to May 2018.

Sample size: 820students.

Sample size calculation: All the students who were willing to participate in the study were selected.

Subjects & selection method: Universal sampling

Inclusion criteria:
1.   Students willing to participate in the study
2.   Either sex

Exclusion criteria:
1.   Students writing exams
2.   Students who were absent

Materials and methods

This cross sectional study was conducted in seven disciplines of education which included undergraduate students of MBBS, BDS, BPT, BE,B.Sc Nursing, BBA and BALLB. All the students of seven disciplines of education who were willing to participate in the study were selected. The purpose and objective of the study was clearly explained to the students through an information sheet and they were informed that their participation was optional. It was emphasized that all the data collected will be kept strictly confidential.After written informed consent was obtained, latest version of VARK Questionnaire (Version 7.8)which is a 16 itemed, self-reporting, multi choice questionnairein the form of hard copies was used to collect the data of the students.[5]. The questionnaire included the demographic details such as Name, Age, Gender, Address, Year of study and Discipline of study. The students were permitted to choose 2 or more options for a question or even omit a question if appropriate. The time taken to complete the questionnaire was approximately 10 – 15 minutes.

Statistical analysis:

Data was analyzed using SPSS version 23.Descriptive statistics were performed and presented in the forms of tables and charts. One-way ANOVA test was used to ascertain the significance of differences between mean values of multiple pairs of different courses. The level $P < 0.05$ was considered as the cutoff value or significance.

III. Result

3.1. Age and gender of the students

In this study, average age of the student is 21.42 years with SD of 0.585years. Majority of the students are 21 and 23 years old and totally 820 students are involved in the study.Out of 820 students, 52% are males and 48% are females.

3.2Types of courses among the students

One third of the students (31%) are BE students and the second highest are MBBS students (22%).These are followed by BALLB (14.6%), BDS (11.2%), BPT (7.8%), BBA(7.2%) and B.Sc Nursing (5%).
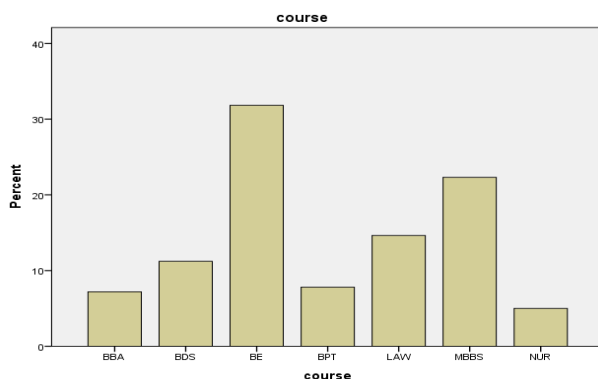
Figure1. Distribution of courses among the participants

3.3. Distribution of answers for the VARK questionnaire

Table 1: The overall distribution of the responses for the VARK questionnaire

Question no.	V	A	R	K
Q1	424	275	350	465
Q2	424	275	350	465
Q3	424	275	350	465
Q4	424	275	350	465
Q5	424	275	468	347
Q6	424	275	350	465
Q7	424	275	350	465
Q8	424	275	350	465
Q9	424	275	350	465
Q10	468	231	306	509
Q11	424	275	350	465
Q12	424	275	350	465
Q13	424	275	350	465
Q14	391	242	383	498
Q15	424	275	350	465
Q16	424	275	350	465
Total	6795	4323	5707	7399

Students prefer kinesthetic way of learning with highest frequency (7399). The second highest preference is seen in visual way of learning (6795), followed by read/write and auralway of learning, showing frequencies of 5707 and 4323 respectively. Similar number of responses is seen for all questions except slightly different responses are seen in Q5 and Q10. In comparison with other questions, the students choose more R and less K for the Q5 and more V and K answers and less A and R answers for Q10.

3.4. The relationship between course of study and preference of VARK
3.4.1. The association between different courses and their preference on visual learning

Table 2: Major disciplines and their preference on visual learning
Dependent Variable: Total number of Visual learning

Method of analysis	(I) MjCourses	(J) MjCourses	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Scheffe	BDS	BE	3.48*	.935	.003	.86	6.10

		MBBS	-1.37	.986	.588	-4.13	1.39
		Other	.84	.925	.843	-1.75	3.43
	BE	BDS	-3.48*	.935	.003	-6.10	-.86
		MBBS	-4.85*	.744	.000	-6.93	-2.77
		Other	-2.64*	.661	.001	-4.49	-.79
	MBBS	BDS	1.37	.986	.588	-1.39	4.13
		BE	4.85*	.744	.000	2.77	6.93
		Other	2.21*	.731	.028	.16	4.26
	Other	BDS	-.84	.925	.843	-3.43	1.75
		BE	2.64*	.661	.001	.79	4.49
		MBBS	-2.21*	.731	.028	-4.26	-.16

One-way ANOVA analysis is done to find out the significant difference of preferences among the study population. The significant p-value (<0.05) is seen for the Levene's Test showing F $(3,816) = 9.016$. Multiple comparison table shows the significant differences in their average number of preferences among the groups. Regarding the average number of preferences on visual learning, MBBS shows the highest number 10.75 and the second highest is seen among BDS students showing 9.38times. Students from other disciplines and BDS show 8.57 and 9.38 times respectively.

There are significant differences in the average number of selecting visual learning as their preference among the different disciplines. BDS students prefer more on visual learning than BE students with mean difference 3.48 times and it is statistically significant (p-value<0.05). Another significant finding is seen among BE and MBBS students. More preference on visual learning is seen among the MBBS students comparing to BE students showing the average difference of 4.85 times and p value<0.05.

Significant difference is seen among the BE, MBBS and other disciplines (BBA, BPT,BALLB, B.Sc Nursing). Comparing the students from other disciplines, BE students show less preferences on visual learning,comprising mean differences of 2.64 times with p-value 0.001 (<0.05). However, MBBS students prefer more visual learning than other disciplines showing mean difference of 2.21 and p-value 0.28 (<0.05).

3.4.2. The association between different courses and their preference on aural learning

The students' preferences on aural learning are compared based on the different courses by using one way ANOVA.The average preferences of aural learning show similar number for BE and other disciplines (BBA, BPT, BALLB, B.Sc Nursing), showing 6.32 and 6.19 respectively, these are followed by BDS students with an average of 5.99 times. Comparing to others, MBBS shows very low preference on aural learning with average number of 1.98.

There is significant difference between the groups as Lavene's test shows F$(3,816)=140.37$ with p-value <0.05.Based on the multiple comparisons table on aural learning, BDS students have more aural preference than MBBS with 4.01 mean differences. The difference is statistically significant with p-value 0.000(<0.05).Similarly, BE students prefer more on aural learning than MBBS students, showing average difference of 4.34 and p-value <0.05. Students from other disciplines also comprise more aural learning than MBBS students. Mean difference between these two groups is 4.21 and statistically significant at p-value 0.000(<0.05).

Based on the results, MBBS students significantly less prefer to aural learning than BDS,BE and other disciplines.

Table 3: Major disciplines and their preference on aural learning
Dependent Variable: Total number of aural learning

Method of analysis	(I) MjCourses	(J) MjCourses	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Scheffe	BDS	BE	-.33	.877	.986	-2.79	2.12
		MBBS	4.01*	.924	.000	1.42	6.59
		Other	-.20	.867	.997	-2.63	2.23
	BE	BDS	.33	.877	.986	-2.12	2.79
		MBBS	4.34*	.697	.000	2.39	6.29
		Other	.13	.620	.998	-1.61	1.87
	MBBS	BDS	-4.01*	.924	.000	-6.59	-1.42
		BE	-4.34*	.697	.000	-6.29	-2.39
		Other	-4.21*	.685	.000	-6.13	-2.29
	Other	BDS	.20	.867	.997	-2.23	2.63
		BE	-.13	.620	.998	-1.87	1.61
		MBBS	4.21*	.685	.000	2.29	6.13

Based on observed means
The error term is Mean Square (Error) = 52.288.
*. The mean difference is significant at the .05 level.
Based on observed means
The error term is Mean Square (Error) = 59.478

3.4.3. The association between different courses and their preference on Read/Write Learning

Table 4: Major disciplines and their preference on Read/Write learning
Dependent Variable: Total number for Read/Write learning

Method of analysis	(I) MjCourses	(J) MjCourses	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Scheffe	BDS	BE	.59	.887	.931	-1.89	3.08
		MBBS	6.29*	.935	.000	3.67	8.91
		Other	.29	.878	.990	-2.17	2.75
	BE	BDS	-.59	.887	.931	-3.08	1.89
		MBBS	5.70*	.705	.000	3.72	7.67
		Other	-.30	.627	.973	-2.06	1.46
	MBBS	BDS	-6.29*	.935	.000	-8.91	-3.67
		BE	-5.70*	.705	.000	-7.67	-3.72
		Other	-5.99*	.693	.000	-7.94	-4.05
	Other	BDS	-.29	.878	.990	-2.75	2.17
		BE	.30	.627	.973	-1.46	2.06
		MBBS	5.99*	.693	.000	4.05	7.94

Based on observed means.
 The error term is Mean Square(Error) = 53.517
*. The mean difference is significant at the .05 level.

Based on the above findings, the mean values for the Read/Write preference are similar among the students of BDS,BE and other disciplines (BBA, BPT,BALLB, B.ScNursing), showing 8.65, 8.06,8.36 times respectively. However, MBBS shows only 2.37 times as average preference with SD of 5.17.

According to the Lavene's test, F value is 257.58 with df 3and 816 and statistically significant p-value <0.05. Multiple comparisons are done using Scheffe test and Bonferroni adjustment is also done for the analysis. The mean differences are significant at the 0.05 level for BDS and MBBS, BE and MBBS, MBBS and other disciplines. BDS students have higher preference on read/write learning than MBBS students with mean difference 6.29 times and this finding is statistically significant at <0.05 level.BE students also show more preference on read/write learning than MBBS students, revealing average difference of 5.7 and significant p-value <0.005.Students from BBA,BPT,BALLB and B.ScNursing also show more preference on read/write than MBBS and their mean difference is nearly 6 with significant p-value<0.05.

So based on the overall results of Read/Write preference among the students, MBBS students less prefer to it comparing to BDS,BE and other disciplines. The results are significant at p-value <0.05.

3.4.4. The association between different courses and their preference on Kinesthetic Learning

Table 5. Major disciplines and their preference on kinesthetic learning
Dependent Variable: Total number of kinesthetic learning

Method of analysis	(I) MjCourses	(J) MjCourses	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Scheffe	BDS	BE	2.68*	.919	.037	.11	5.26

		MBBS	-.98	.969	.795	-3.69	1.73
		Other	2.18	.909	.125	-.37	4.73
	BE	BDS	-2.68*	.919	.037	-5.26	-.11
		MBBS	-3.66*	.731	.000	-5.71	-1.61
		Other	-.50	.650	.898	-2.32	1.32
	MBBS	BDS	.98	.969	.795	-1.73	3.69
		BE	3.66*	.731	.000	1.61	5.71
		Other	3.16*	.718	.000	1.15	5.17
	Other	BDS	-2.18	.909	.125	-4.73	.37
		BE	.50	.650	.898	-1.32	2.32
		MBBS	-3.16*	.718	.000	-5.17	-1.15

Based on observed means.
The error term is Mean Square(Error) = = 57.448*.
The mean difference is significant at the .05 level.

Regarding kinesthetic learning, the average number of preferences for MBBS and BDS are 11.39 and 10.41 respectively. These figures are followed by students of other disciplines and BE, comprising 8.23 and 7.73 times respectively. MBBS shows highest average of preference on kinesthetic learning comparing to others.

There is a significant findings in the Lavene's test with p-value 0.000 (<0.05) and $F_{(3,816)}=46.797$. According to one-way ANOVA test results, significant mean differences are seen in between BDS and BE, BE and MBBS and MBBS and other disciplines (BBA, BPT,BALLB, B.ScNursing). BDS students prefer more on kinesthetic learning than BE students. The mean difference between these two groups is 2.68 and it is significant at p-value 0.05 level. On the other hand, MBBS students prefer more than BE students on kinesthetic learning showing 3.66 mean differences with statistical significant p-value at 0.05 level. So also, MBBS students prefer more kinesthetic learning than students from other disciplines (BBA, BPT,BALLB, B.ScNursing) with significant difference in mean value 3.16 (p value <0.05).

IV. Discussion

VARK is an acronym for visual, aural, read/write, kinesthetic learning modalities. VARK questionnaire which was first developed by Neil Fleming has been updated and modified regularly. It is a tool that is easy to use and can give teachers information on learning style preferences and how to maximize the potential of students learning.

In this study, the VARK questionnaire was administered to final year undergraduate students pursuing different courses to identify their learning style preferences. Based on the assessment of the research data acquired, majority of students are multimodal learners. Large group of students preferred kinesthetic learning style irrespective of the courses they studied. A second preference was given to the visual learning. Least preferred were read/ write and aural learning styles which were represented rather equally.

Most individuals have a preferred way of gathering, interpreting and organizing information. Some learn best by active manipulation, others by reading, some by talking about it and some by listening. No single style of learning has been shown to be better than any other and no single style leads to better learning. Nonetheless, it is important to recognize that a variety of learning styles exist and there is a need to develop a range of teaching strategies.

Psychologically, learning style is the way students concentrate, process information and obtain knowledge, or experience.[6]. On the other hand, from the cognitive aspect, learning style can be referred to various methods adopted in perceiving information and processing it to form concepts and principles.[7].

Findings from this study showed that the traditional method of learning through lectures and reading textbooks has become less popular with MBBS students and a majority of them preferred kinesthetic learning (Table.5). Including more practical components, field trips, case studies, role plays and real life experiences, illustrations, graphs into the curriculum may improve the learning of MBBS students as they seem to be better visual and kinesthetic learners. Wolfman and Bates (2005) view kinesthetic learning style as able to increase student's learning motivation.[8].

However, BDS students were more visual learners and also comfortable with aural and the traditional reading and writing mode of learning(Table 3&4). Visual learners like to use figures, pictures, and symbolic tools such as graphs, flowcharts, hierarchies and models which represent printed information.As they are aural learners these students give more attention to the words delivered by teachers, discuss topics which were taught

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with classmates, as a way to clarify their understanding. These students also resort to the use of textbooks and tend to depend on written notes and like to arrange lecture notes into sketch form.[9].Learning through video will be effective way of teaching for BDS students as it can encourage both visual and aural learning according to their preferred styles.

Engineering and other graduates preferred the aural learning as well as the read/write style which is most commonly used in a traditional class room setup (Table 3). It has been discovered that the mode that is most commonly used in learning process is speech mode and this is represented as aural mode based on a study by Fleming(1995).[10]. These students pay a lot of attention to the lecture, and prefer to listen recorded information. This type of students can remember information through loud reading especially when learning something new. Students can strengthen their memory by listening over and over to audio tape recordings, by teaching other people and discussing with teachers.[11]. Students with the tendency of reading prefer printed word and text as a method to gain information. They study better through notes taken from lecture .[12].

Also allowing students to access information at their comfort zone will increase their academic confidence. By understanding what kind of learners our students are, we can gain a better perspective on how to implement these learning styles into our lesson plans and study techniques. With different education approaches, educators may give opportunities and experiences to students of different backgrounds of learning styles .[13].

V. Conclusion

In summary, using the validated VARK questionnaire we showed that majority of our undergraduate students are multimodal learners. Most of the students preferred kinesthetic learning followed by visual, aural and read and write modes of learning. The results obtained from this study provide convincing evidence for educators to use a blended teaching approach to accommodate different learning styles to promote learning.The VARK questionnaire helps in gathering information about the students preferred sensory modalities in learning thus, giving a better perspective to educators on how to incorporate these learning styles into curriculum and assessment and also to improve the learning strategies.

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