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Assessment Of Preferred Learning Styles Among Students Of Dental Colleges In South India Using VARK Approach.

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Abstract
Purpose:
Educational researchers have postulated that each individual has a unique learning style. Many methods are available for assessing the learning styles, with each method offering a distinctly different view of the learning style preferences. VARK is a questionnaire which was developed by Neil Fleming in 1987 improve faculty development and to help students become better learners. This study was conducted to assess the preferred learning style among students of randomly selected dental colleges of South India using VARK approach
Methods:
An online survey was conducted using a Google form among all third and final year students of randomly selected dental colleges of South India. The VARK questionnaire containing 16 multiple choice questions with four possible responses was mailed to them. The students were asked to select one or more choices, based on the sensory modalities preferred by them. The responses were recorded and analysed.
Results:
Overall, 40.8% of the participants preferred quad-model (VARK), 57.7% preferred tri-model (VAK, VAR, ARK, VRK) and 1.5% preferred bi-model learning style (VR, VA, AR). The quad-model was preferred mostly by the third and final year dental students in Tamil Nadu and the tri-model by the third and final year students in Kerala.
Conclusion:
This study showed that majority of the dental students in South India preferred a tri-modal and quad-model learning style.
Keywords: *Curriculum, teaching, education*

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I. Introduction

The learning style is defined as the "composite of the characteristic cognitive, affective and the physiological characters that serve as the relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment[2]. Students basically use different approaches to obtain required

information, as their learning is affected by learning atmosphere and curricular issues, as well as teaching methods[3].

Every teaching methodology has its pros and cons. Effective lectures combine the talents of scholar, writer, producer, comedian, showman and researcher in ways that contributed to students learning as well stated by McKeachie. Dr. Malcolm Knowles' theory about adult learning is widely accepted and is based on the principle that learning should be "learner-centered". As adults learn, they move from a dependent state to one that is more self-directed. One way to encourage students' active involvement in their education is to give them tools to help them become better learners regardless of the setting in which they are learning. One tool that can be used to facilitate this is a learning style inventory. The teachers can address learner's needs by utilizing a variety of teaching methods and teaching styles so that learners are exposed to both familiar and unfamiliar ways of learning, ultimately giving learners multiple ways to excel.[1]

The undergraduate dental education, as with any other educational program, needs ongoing improvements to meet the changing demands of the dental practice in the 21st century[1] and the students might experience substantial stress in the process of adapting to a highly demanding new learning environment.[4] Although the complexities of the dental care have increased dramatically over the last century, the method of teaching medicine has hardly changed. Recently, there has been a widespread interest in assessing learning styles among students.

Many methods are available for assessing the learning styles, with each method offering a distinctly different view of the learning style preferences. VARK is a questionnaire which was developed by Neil Fleming in 1987, who was a teacher and an educator in New Zealand.[5] It was developed in an effort to improve faculty development and to help students become better learners.[6] The VARK questionnaire is an easy-to-use 16-question survey that provides the users with a profile of their learning preferences.[7] V stands for the Visual, A stand for Aural, R stands for Reading and K stands for Kinesthetic.

Flemming and Miles defined four sensory modalities of learning: Visual, auditory, read-write and kinesthetic. Visual learners are those who generally think in terms of pictures. They find maps, graphs, charts, and other visual learning tools to be extremely effective. Auditory learners are those who learn best through hearing things. Some students use reading and writing as their first preferences for assimilating and accommodating to information[8]. A kinesthetic student typically learns best by hands-on methods[9]. The students acquire information through experience and practice, and prefer to learn information that has a connection to reality[6]

The Visual learners prefer the use of symbolic devices such as diagrams, graphs, flow charts and models that represent the printed information. The Auditory learners prefer "heard" information and, thus, they learn better through discussions, lectures, tutorials and talking, through material, with themselves or others. The Read-write learners prefer printed words and texts as a means of acquiring new information; they thus prefer textbooks, lecture notes, handouts, lists and glossaries. Kinesthetic learning employs a combination of the sensory functions; such learners have to feel or live the experience to learn; they prefer simulations of real practices and experiences, lessons that emphasize on performing an activity, field trips, exhibits, samples, photographs, case studies, "real-life examples," role-plays, and applications to help them understand the principles and advanced concepts. Some learners have a preference for any one of these learning modalities (unimodal learners), whereas the multimodal learners do not have a strong preference for any single method. They rather learn via two or more of the modalities. The multimodal learners thus are sub-classified as Bimodal (VA, VR, VK, AR, AK, RK), Trimodal (VAR, VAK, VRK, ARK), and quadmodal (VARK) learners, who prefer to use two, three, or four styles, respectively.

Students with knowledge of their learning styles could be empowered to identify and use the techniques of learning best suited to their individual styles, resulting in greater educational satisfaction[10]. A review of scientific literature showed no studies comparing the learning styles of dental students from various dental colleges in India. This necessitates the present study which was to assess the preferred learning styles of students from randomly selected dental colleges of South India.

II. Materials And Methods

A cross-sectional descriptive study was conducted from August 2018 – September 2018 to assess the preferred learning style among dental students of randomly selected dental colleges of South India using VARK approach. The study participants comprised of all the third year and final year students studying in the selected dental colleges in South India**.** The area selected for the study were 2 randomly selected dental colleges from each state of South India. They were:

1) Manipal College of Dental Sciences, Karnataka
2) A J Institute of Dental Sciences, Karnataka
3) K S R Institute of Dental Science and Research, Tamil Nadu
4) Vinayaka Missions Sankarachariyar Dental College, Tamil Nadu

5) Azeezia College of Dental Sciences and Research, Kerala
6) Amrita School of Dentistry, Kerala
7) Lenora Institute of Dental Sciences, Andhra Pradesh
8) Narayana Dental College & Hospital, Andhra Pradesh
9) MNR dental college and hospital, Telangana
10) SVS Institute of Dental sciences**,** Telangana

We included third year and final year students who consent to participate studying in selected dental colleges in South India and excluded participants who do not respond to the email.

The protocol for the study was submitted before Yenepoya University Ethics Committee and request for ethical clearance was made. The ethical approval for the study was obtained from the Institutional Ethical Committee (Protocol no: 2017/137), Yenepoya University. Permission to conduct the study was obtained from the Head of the respective institutions and informed consent was obtained from each participant.

Two dental colleges from each state were randomly selected by using lottery method. An online survey form (Google form) was mailed to the all 3rd year and final year BDS students of the selected colleges. The online survey form contained 2 domains. The first domain contained the information about the study, informed consent form, details like age, gender, year of study, marks in percentage obtained in previous year university examination. The second domain contained the VARK questionnaire. The VARK-questionnaire contained 16 multiple choice–questions with four possibilities to select an answer. Each possibility represented one of the four modes of perception. The four modes of perception were visual (V), aural(A), read/write(R), kinematic(K). The students can select one or more choices, based on the sensory modalities which are preferred by them, to take in new information, which was necessary for the identification of the poly modal modes of perception and learning. The students were asked to record their responses and return the online survey form. The responses were recorded and assessed to know the preferred learning style of dental students from the various dental colleges

Statistical Analysis

The data collected was entered in Microsoft Excel Software by the examiner. Data analysis was done using SPSS 22.0 (Statistical Package for Social Sciences). Descriptive statistics were used for the analysis of data and distribution of study variables. Chi square test was used to find the association between study variables. The level of significance was set at $p<0.05$.

III. Results

The online survey form was mailed to 1544 students. 814 students responded out of which 412 III year and 402 IV year BDS students who were included in the study. The mean age of the participants was 20.39 years.

1.52% of the participants preferred bi-modal, 57.72% preferred tri-modal and 40.78% preferred quad-modal learning modality. [**Figure 1]**

While comparing the frequencies between III and IV BDS students, IV BDS students preferred quad-model more in Karnataka (52.22%), Tamil Nadu (63.09%), Andhra Pradesh (41.33%) and Telangana (26.56%). (Table 1) and III BDS students preferred quad model more in Kerala (35.95%). Conversely in preference of tri-model, III BDS students preferred more in Karnataka (54.34%), Tamil Nadu (49.42%), Andhra Pradesh (56.79%)and Telangana (76.19%) while IV BDS students preferred more in Kerala (76.13%). Among participants who preferred bi-model, in Karnataka 2(2.19%) students were in III BDS, in Andhra Pradesh 3(3.71%) were in III BDS and 3(4.01%) were in IV BDS and in Telangana 4(6.26%) were in IV BDS. [**Table 1**]

Table 2 shows the comparison of frequency of preferred learning style between III and IV BDS students of same dental college. In Manipal College of Dental Sciences (MCODS), Karnataka, 21 preferred quad model, 26 preferred tri modal among III BDS students and 29 preferred quad model and 16 preferred tri modal among IV BDS students. In A J Institute of Dental Sciences (AJ), Karnataka, 19 preferred quad model, 24 preferred tri modal, 2 preferred bi modal among III BDS students and 18 preferred quad model and 28 preferred tri modal among IV BDS students.

In K S R Institute of Dental Science and Research (KSR), Tamil Nadu, 27 preferred quad model, 19 preferred tri modal among III BDS students and 31 preferred quad model and 13 preferred tri modal among IV BDS students. In Vinayaka Missions Sankarachariyar Dental College (VMSDC), Tamil Nadu, 17 preferred quad model, 24 preferred tri modal among III BDS students and 22 preferred quad model and 18 preferred tri modal among IV BDS students.

In Azeezia College of Dental Sciences and Research (Azeezia), Kerala, 19 preferred quad model, 27 preferred tri modal among III BDS students and 14 preferred quad model and 34 preferred tri modal among IV

BDS students. In Amrita School of Dentistry (Amrita), Kerala, 13 preferred quad model, 30 preferred tri modal among III BDS students and 7 preferred quad model and 33 preferred tri modal among IV BDS students.

In Lenora Institute of Dental Sciences (LIDS), Andhra Pradesh 17 preferred quad model, 22 preferred tri modal among III BDS students and 13 preferred quad model and 19 preferred tri modal among IV BDS students. In Narayana Dental College & Hospital (Narayana), Andhra Pradesh, 15 preferred quad model, 24 preferred tri modal, 3 preferred bi modal among III BDS students and 18 preferred quad model, 22 preferred tri modal and 3 preferred bi modal among IV BDS students.

In MNR dental college and hospital (MNR), Telangana, 7 preferred quad model, 26 preferred tri modal among III BDS students and 9 preferred quad model and 22 preferred tri modal among IV BDS students. In SVS Institute of Dental sciences (SVS), Telangana, 21 preferred quad model, 26 preferred tri modal among III BDS students and 29 preferred quad model and 16 preferred tri modal, 4 preferred bi modal among IV BDS students.

There was no significant difference in preference of each learning style among III and IV BDS students of the same dental college.

Table 3 shows the comparison of association between gender and preferred leaning style among students. Among males 271 preferred tri modal, 168 preferred quad model and 8 preferred bi modal. Among females 199 preferred tri modal, 164 preferred quad model and 4 preferred bi modal. There was a significant association between gender and preferred learning style and mostly males preferred tri modal than females.

Table 4 shows the comparison of association between age and preferred leaning style among students. Among the students aged 19 years, 60 preferred quad model, 110 preferred tri model and 4 preferred bi model. Among the students aged 20 years, 121 preferred quad model, 177 preferred tri model and 8 preferred bi model. Among the students aged 21 years, 102 preferred quad model and 138 preferred tri model. Among the students aged 22 years, 43 preferred quad model and 31 preferred tri model. Among the students aged 23 years, 4 preferred tri model. Among the students aged 25 years, 6 preferred quad model. Among the students aged 27 years, 9 preferred tri model. There was a significant difference between 19, 20 and 21 age group who preferred tri modal than quad/bi modal.

Table 5 shows the comparison between the learning technique and performance of the student in the previous university examination. Among students who scored 1st class and distinction, 83.3% students preferred quad model and 28.17 preferred tri modal learning modality which was statistically found significant. Among students who scored less than 1st class, 32.1% students preferred quad model and 16.95% preferred tri modal learning modality

IV. Discussion

The present study showed that the students had a higher preference for multimodal learning than unimodal learning which is in agreement with the studies conducted by Shenoy N et al[2] and Peyman H et al[3]. Among the multi modal techniques, most of the students preferred quad model (VARK), followed by tri modal (ARK, VAR, VAK, VRK).

Among III BDS students quad model was mostly preferred by students of dental colleges of Tamil Nadu and least by students of Telangana and tri modal was mostly preferred by students of dental colleges of Telangana and least by students of Tamil Nadu.

Among IV BDS students quad model was mostly preferred by students of dental colleges of Tamil Nadu and least by students of Kerala and tri modal was mostly preferred by students of dental colleges of Kerala and least by students of Tamil Nadu.

While comparing the III BDS and IV BDS students who preferred quad model learning technique, IV BDS students of dental colleges in Karnataka, Tamil Nadu, Andhra Pradesh and Telangana preferred quad model more than III BDS students whereas in Kerala, the III BDS students preferred quad model more than IV BDS students.

While comparing the III BDS and IV BDS students who preferred tri model learning technique, III BDS students of dental colleges in Karnataka, Tamil Nadu, Andhra Pradesh and Telangana preferred tri model more than IV BDS students whereas in Kerala, the IV BDS students preferred tri model more than III BDS students.

The present study shows significant association with the age and preferred learning style of the students. This is in consistency with the studies conducted by Khanal L et al[1]. Whether the difference in learning style was due to different level of medical education or due to increasing age was not clear so it necessitated the further research by taking account the both factors.

This study also shows a significant association between gender and preferred learning style of the students. This is in consistency with the studies conducted by Khanal L et al[1] and Peyman H et al[3] which showed a significant association between participant's gender and their preferred learning styles (p=0.03). There is a large body of literature available on gender differences in learning. It has been reported that males

have a preference for rational evaluation and logic, whereas females use "elaborative" processing in which they tend to seek personal relevance or individual connections with the material being taught. In addition, males are more achievement oriented, while females are more socially and performance oriented.

The present study shows significant association between the marks obtained in the previous year university exam and the preferred learning style of the students which is also in agreement with other studies conducted by Al-Saud LMS[12] that showed a statistically significant association in (p=0.019). Most of the students who secured 1st class and distinction used the quad model as the preferred learning style.

Educational researchers have postulated that each individual has a unique learning style. The health care educators should be aware about the learning styles of their students. The knowledge on the learning styles may help the educators in identifying and solving the learning problems among the students, thus helping their students to become more effective learners. While doing so, it may be possible to reach out to more students because of the better match between the teacher and the learner styles. Similarly, students with knowledge of their learning styles could be empowered to identify and use the techniques of learning best suited to their individual styles, resulting in greater educational satisfaction

V. Conclusion

Based on the findings of the study majority of the dental students in South India preferred a multi modal than uni modal learning style. Overall, 40.8% of the participants preferred quad-model, 57.7% preferred tri-model and 1.5% preferred bi-model learning style. VARK (40.78%) and ARK(20.51%) were the mostly preferred multi modal learning style. The quad-model was preferred mostly by the III and IV BDS dental students in Tamil Nadu and the tri-model by the III BDS students of Telangana and IV BDS students of Kerala. The quad model learning was preferred by students in South India who obtained marks above 1st class.

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Tables

Table 1: Comparing the frequencies between III and IV BDS students who preferred different learning styles

Learning modalities	Year of study	Karnataka	Kerala	Tamil Nadu	Andhra Pradesh	Telangana
Quad-modal	III BDS	40(43.47%)	32(35.95%)	44(50.57%)	35(39.50%)	15(23.80%)
	IV BDS	47(52.22%)	21(23.86%)	53(63.09%)	31(41.33%)	17(26.56%)
Tri-modal	III BDS	50(54.34%)	57(64.04%)	43(49.42%)	46(56.79%)	48(76.19%)
	IV BDS	44(48.88%)	67(76.13%)	31(36.90%)	41(54.66%)	43(67.18%)

Bi-modal	III BDS	2 (2.19)	0 (0.00%)	0 (0.00%)	3 (3.71%)	0 (0.00%)
	IV BDS	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (4.01%)	4 (6.26%)

Table 2: Comparison of frequency of preferred learning style between III and IV BDS students of same dental college

State	Colleges	Quad model	Tri model	Bi model	p – value
Karnataka	MCODS III BDS	21	26	0	p=0.079 (NS)
	MCODS IV BDS	29	16	0	
	AJ III BDS	19	24	2	p=0.079 (NS)
	AJ IV BDS	18	28	0	
Kerala	Azeezia III BDS	19	27	0	p=0.067 (NS)
	Azeezia IV BDS	14	34	0	
	Amrita III BDS	13	30	0	p=0.062 (NS)
	Amrita IV BDS	7	33	0	
Tamil Nadu	KSR III BDS	27	19	0	p=0.072 (NS)
	KSR IV BDS	31	13	0	
	VMSDC III BDS	17	24	0	p=0.071 (NS)
	VMSDC IV BDS	22	18	0	
Andhra Pradesh	LIDS III BDS	17	22	0	p=0.093 (NS)
	LIDS IV BDS	13	19	0	
	Narayana III BDS	15	24	3	p=0.069 (NS)
	Narayana IV BDS	18	22	3	
Telangana	MNR III BDS	7	26	0	p=0.089 (NS)
	MNR IV BDS	9	22	0	
	SVS III BDS	8	22	0	p=0.083 (NS)
	SVS IV BDS	8	21	4	

Chi square test p>0.05 Non significant, NS

Table 3: Comparison of association between gender and preferred leaning style among students

Gender	Quad model	Tri model	Bi model	p – value
Male	168	271	8	p=0.01*
Female	164	199	4	

Chi square test *p<0.05 statistically significant

Table 4: Comparison of association between age and preferred leaning style among students

Age (years)	Quad model	Tri model	Bi model	p – value
19	60	110	4	p<0.001*
20	121	177	8	
21	102	138	0	
22	43	31	0	
23	0	4	0	
25	6	0	0	
27	0	9	0	

Chi square test *p<0.05 statistically significant

Table 5: Comparison of association between the learning technique and performance in the previous university examination

Marks obtained	Quad model (%)	Tri model (%)	p-value
1st class and distinction	83.3	28.17	p<0.001*
< 1st class	32.1	16.95	NS

Chi square test *p<0.05 statistically significant, p>0.05 Non significant, NS

1st class: ≥60 % marks, Distinction: ≥75 % marks

Figures

Figure 1: Distribution of participants based on learning modality