

Learning preferences of undergraduate dental students using VARK analysis

Shrestha A¹  , Marla V² , Shrestha S³ , Rimal J⁴ 

¹Ashish Shrestha, Additional Professor, Department of Oral Pathology, B.P. Koirala Institute of Health Sciences, Dharan, Sunsari, Nepal; ²Vinay Marla, Lecturer, Department of Oral Pathology, Penang International Dental College, Penang, Malaysia; ³Sushmita Shrestha, Assistant Professor, Department of Conservative Dentistry and Endodontics, B.P. Koirala Institute of Health Sciences, Dharan, Sunsari, Nepal; ⁴Jyotsna Rimal, Professor, Department of Oral Medicine and Radiology, B.P. Koirala Institute of Health Sciences, Dharan, Sunsari, Nepal.

Abstract

Background: Learning preference is a complex character in which learners most efficiently perceive, process, store, and recall what they are learning.

Objectives: This study was conducted with an objective to identify the preferred learning styles of undergraduate dental students such that suitable modification in the teaching learning environment could be made.

Methodology: An analytical cross-sectional study was carried at B.P. Koirala Institute of Health Sciences, Nepal among undergraduate dental students from June to December 2019 after getting ethical approval. Convenience sampling method was used to include all undergraduate students from first to final year; of which 252 provided consent. VARK questionnaire (version 7.8) comprising 16 multiple choice questions were used to analyse the learning preferences and were accordingly categorised for further statistical analysis.

Results: Out of 280 students, a total of 252 (90%) students (90 males, 162 females) responded to the questionnaire among whom 89 (35.3%) had uni-modal learning preferences. Of the total, 55 (21.8%) had bi-modal, 39 (15.4%) had tri-modal, and 69 (27.3%) had quadri-modal learning preferences. Among the uni-modal preferences, 'K mild' was most common (36, 14.3%) followed by 'A mild'. Among bi-modal learning preferences 'AK type' (35, 13.9%) was most common and VAK type was common among tri-modal learning preferences. 'VARK type two' (33, 13.1%) was common quadri-modal learning preferences.

Conclusion: This study highlighted the variations in learning preferences among dental students suggesting the need for a flexible learning environment. Understanding learning preferences can help to plan lessons effectively and help to manage students in a better way.

Key words: Curriculum; Learning environment; Learning preference; VARK.

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Address for correspondence

Dr. Ashish Shrestha
Additional Professor, Department of Oral Pathology,
B.P. Koirala Institute of Health Sciences,
Dharan, Sunsari, Nepal.
E-mail: ashish.shrestha@bpkihs.edu

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INTRODUCTION

Undergraduate dental program is a professional education program which involves training young individuals with the objective of preparing future dentists¹. Students from different socio-cultural and economic backgrounds converge to learn dentistry, each with different learning preferences.

VARK inventory which is categorised under instructional preference model is a commonly used tool to identify learning preferences². The VARK questionnaire and their results focus on the ways in which people like information to come to them and the ways in which they prefer to deliver their communication. VARK inventory was developed by Neil D. Fleming in 1987 in an effort to improve faculty development and to help students become better learners². It has a set of questions that

determines a person's sensory modality preference. This questionnaire includes four components based on four sensory modalities which include 'V' - visual, 'A' - aural, 'R' - read-write and 'K' - kinesthetic. A student may have single or multiple preferences and this may impact the way he/she learns.

To achieve better outcomes, it is important that medical/dental teachers understand how students learn and how to best use the appropriate teaching-learning methods. Keeping this into consideration, this study was conducted to identify the learning preferences of undergraduate dental students, such that suitable modification in the academic environment could be rendered.

METHODOLOGY

An analytical cross-sectional study was carried out at B.P. Koirala Institute of Health Sciences, Nepal among undergraduate dental students, conducted within a period from June to December 2019. Ethical clearance was obtained from the Institutional Review Committee of the Institute (Ref. 108/073/074) and written informed consent obtained from the participating students. A convenience sampling method was used to include all undergraduate dental students (first, second, third, fourth, and final years). Two hundred and fifty-two of the total of 280 students provided consent.

The study was conducted in respected 'lecture theatres' assigned for each batch of students. Prior permission was obtained from the program coordinator's office to conduct the study without hampering the routine academic activities.

The study was divided into two sections. Section A was for collecting the demographic information like, roll number, age, gender, and academic year. Roll number of the students was included to provide feedback on the basis of information regarding their learning preferences. However, individual learning preferences were kept confidential. Section B consisted of a VARK questionnaire. The questionnaire (version 7.8) comprising 16 multiple choice questions was used after obtaining formal consent from Dr. Neil D. Fleming. The questionnaire was adapted from the VARK website (<https://vark-learn.com/the-vark-questionnaire/>).

The obtained data were entered in Microsoft Excel spreadsheets and transferred to SPSS Statistics for Windows, version 11.5 (SPSS Inc., Chicago, Ill., USA) for

further statistical analysis. The data obtained for the standard scoring system was used for further statistical analysis. The quantitative data were obtained and the measurement was on a nominal scale. Comparison of VARK scores based on age group, gender, academic years were done using Chi-square test. The statistical analyses were considered as significant at p-value less than 0.05.

RESULTS

Two hundred and fifty two students (90%) participated in the study among which 90 (35.7%) were males and 162 (64.3%) were females with mean age 21.1 ± 1.7 years. The distribution of the students were: 56 (22.2%) first year, 58 (23.0%) second year, 56 (22.2%) third year, 45 (17.8%) fourth year, and 37 (14.6%) from final year; all belonging to the age range 18 to 27 years.

The results from the standard algorithm of VARK analysis were considered for descriptive and analytical statistical analysis. Of the participating students, 89 (35.3%) had uni-modal and 163 (64.6%) had multimodal learning preferences, however not statistically significant ($p=0.58$). Also, no statistical significance was observed on categorisation of the learning preferences and comparing with the sex among the participating students ($p=0.93$) (Table 1).

Among students who had a single learning preference, 'K mild' (36, 14.3%) was the most common, followed by 'A mild' (13, 5.2%) and 'K strong' (11, 4.4%). Table 2 exhibits the general distribution of learning preferences among the dental students.

Among the students who had bi-modal learning preference 'AK' (aural/kinesthetic) (35, 13.9%) was the common type followed by 'VK' type (10, 4%). The most preferred learning style was 'K mild' among first (10, 17.9%), second (8, 13.8%) and third (11, 19.6%) year students and VARK type two (8, 17.8%) was common among fourth year and VAK (6, 16.2%) among fifth year students. Overall the most common learning preferences were 'K mild' (36, 14.3%) type followed by 'AK' type (35, 13.9%) and VARK type two (33, 13.1%). The least preferred learning style was 'R very strong' (1, 0.4%). Multimodal learning preference was the most common learning preference among all the students. No statistical significance was observed among the learning preferences and academic years of the dental students ($p=0.71$) (Table 3).

Table 1: Learning preferences of students depending upon sex

	Sex	Frequency, n (%)	Total, n (%)	p-value
Uni-modal	Male	34 (13.4)	89 (35.3)	0.931
	Female	55 (21.8)		
Bi-modal	Male	19 (7.5)	55 (21.8)	
	Female	36 (14.2)		
Tri-modal	Male	14 (5.5)	39 (15.5)	
	Female	25 (9.9)		
Quadri-modal	Male	23 (9.1)	69 (27.4)	
	Female	46 (18.2)		

Table 2: Description of learning preferences of students of different academic years

Learning preferences		Year 1 n (%)	Year 2 n (%)	Year 3 n (%)	Year 4 n (%)	Year 5 n (%)	Total n (%)
Quadri-modal	VARK type one	5 (8.9)	6 (10.3)	3 (5.4)	4 (8.9)	1 (2.7)	19 (7.5)
	VARK type two	6 (10.7)	6 (10.3)	9 (16.1)	8 (17.8)	4 (10.8)	33 (13.1)
	VARK transition	4 (7.1)	6 (10.3)	5 (8.9)	1 (2.2)	1 (2.7)	17 (6.7)
Tri-modal	VAR	2 (3.6)	-	-	1 (2.2)	1 (2.7)	4 (1.6)
	VAK	2 (3.6)	6 (10.3)	2 (3.6)	4 (8.9)	6 (16.2)	20 (7.9)
	ARK	3 (5.4)	1 (1.7)	2 (3.6)	3 (6.7)	-	9 (3.6)
	VRK	1 (1.8)	2 (3.4)	-	2 (4.4)	1 (2.7)	6 (2.4)
Bi-modal	VA	1 (1.8)	-	-	1 (2.2)	-	2 (0.8)
	AK	9 (16.1)	6 (10.3)	8 (14.3)	5 (11.1)	7 (18.9)	35 (13.9)
	VR	1 (1.8)	1 (1.7)	-	-	-	2 (0.8)
	VK	1 (1.8)	1 (1.7)	3 (5.4)	4 (8.9)	1 (2.7)	10 (4.0)
	RK	1 (1.8)	2 (3.4)	-	-	-	3 (1.2)
	AR	-	1 (1.7)	2 (3.6)	-	-	3 (1.2)
	Uni-modal	V very strong	-	-	1 (1.8)	-	-
	A very strong	1 (1.8)	-	1 (1.8)	1 (2.2)	-	3 (1.2)
	R very strong	-	1 (1.7)	-	-	-	1 (0.4)
	K very strong	-	1 (1.7)	2 (3.6)	2 (4.4)	3 (8.1)	8 (3.2)
	V Strong	1 (1.8)	1 (1.7)	-	-	2 (5.4)	4 (1.6)
	A Strong	3 (5.4)	2 (3.4)	1 (1.8)	-	-	6 (2.4)
	K Strong	2 (3.6)	2 (3.4)	2 (3.6)	3 (6.7)	2 (5.4)	11 (4.4)
	V mild	-	1 (1.7)	-	1 (2.2)	-	2 (0.8)
	A mild	1 (1.8)	4 (6.9)	3 (5.4)	3 (6.7)	2 (5.4)	13 (5.2)
	R mild	2 (3.6)	-	1 (1.8)	-	1 (2.7)	4 (1.6)
	K mild	10 (17.9)	8 (13.8)	11 (19.6)	2 (4.4)	5 (13.5)	36 (14.3)

Table 3: Distribution of students learning preferences according to academic years

Learning preferences	Academic years (n, %)					p-value
	First year	Second year	Third year	Fourth year	Fifth year	
Uni-modal	20 (7.9)	20 (7.9)	22 (8.7)	12 (4.7)	15 (5.9)	0.71
Bi-modal	13 (5.1)	11 (4.3)	13 (5.1)	10 (3.9)	8 (3.1)	
Tri-modal	8 (3.1)	9 (3.5)	4 (1.5)	10 (3.9)	8 (3.1)	
Quadri-modal	15 (5.9)	18 (7.1)	17 (6.7)	13 (5.1)	6 (2.3)	

DISCUSSION

Learning style is a definite indicator of the outcome achieved as described by various studies conducted globally involving different educational streams. Learning styles, as defined by Keefe in 1979 is the composite of cognitive, affective, and physiological characteristics that are relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment³. There are numerous learning style inventories and amongst them VARK[®] inventory which is categorised under instructional preference model is commonly used⁴.

VAR K inventory was developed by Neil D. Fleming in 1987 in an effort to improve faculty development and to help students become better learners². A student may have one single or multiple preferences and this may impact the way he/she learns. The VAR K model has been utilised to assess individual learning preferences in medical, allied health, and non-medical educational programs and provides information about students' learning preferences⁵.

This is the first study in this regard to be conducted for undergraduate dental students in Nepal. Current study included a total of 252 participants from year one to year five of the Bachelor of Dental Surgery (BDS) programme at B.P. Koirala Institute of Health Sciences and comprised of 90 males and 162 females. Descriptive analysis revealed that overall majority of the students had a multi-modal preference of learning accounting for 163 of the study population. This included a cumulative combination of a number of different learning combinations resulting in bi-modal, tri-modal, and quadri-modal learning preferences. However, on the basis of individual preference it was found that the 'K mild type' was the single most preferred form of learning (36, 14.3%), followed by the 'AK bi-modal type' (35, 13.9%) and the 'VAR K type two' quadri-modal learning preference (33, 13.1%). The least learning preference was 'V very strong' and 'R very strong' learning preferences which constituted only 1 (0.4%) among the study population. This was preceded by the 'V mild' uni-modal preference (2, 0.8%), the 'VA' and the 'VR' bi-modal preferences. Similar findings were observed in a majority of studies involving dental students which showed multimodal learning preferences as the most predominant feature among college students of various study streams. Aldosari et al. in their study on dental students in Saudi Arabia, showed that quadri-modal VAR K style was the most preferred learning style followed by uni-modal aural and kinesthetic¹. Similar findings were observed in other studies on dental students in Saudi Arabia and India⁶⁻⁹. However, Liew et al. in their study revealed that 81.9%

of the student population showed uni-modal learning preference¹⁰. Furthermore, these figures are contrasting from another study conducted in B.P. Koirala Institute of Health Sciences, however it was on Anatomy students which found bi-modal learning preference to be the most common and tri-modal to be the least observed learning preference. This could be explained on the basis of variation in the course content and method of instructions between Dentistry and Anatomy¹¹.

Comparison of the change in learning preferences between individual years of the undergraduate dental program did not reveal any significant differences ($p=0.71$). This could be due to the overall teaching and learning methods being uniform throughout the entire program. Teaching and learning in the BDS program involve lectures in the form of 'Structured Interactive Sessions (SIS)' which mostly includes the visual, aural, and read-write component due to the use of multimedia, interactive sessions, discussion sessions, etc. Additionally, practical sessions in the form of preclinical and clinical sessions are conducted in each of the academic years which mainly involve kinesthetic components as well as visual, aural and read-write components. However, contrasting results have been observed in various other studies which show that the learning preferences change as student's progress through different academic years^{1,12}.

In the present study, comparison was done between uni-modal, bi-modal, tri-modal, and quadri-modal learning preferences based on gender and no significant differences were found among these learning preferences. Furthermore, comparison was done between unimodal and multi-modal learning preferences and this yielded insignificant results ($p=0.583$). These findings are different from other studies where significant differences were found between the learning preferences of males and females^{15,19,20}. According to Nuzhat et al. in their study, female students displayed more diversification in terms of learning styles and showed numerous combinations of the VAR K module¹⁵.

Knowing the learning preferences may have a positive effect on the students as well as the teachers. Dental education is complex and knowledge of individual learning preference may be beneficial which might increase the efficiency of the learning process. Many studies have revealed that matching the student's learning styles with the teaching process resulted in improved test scores, whereas mismatch led to decline in academic performance. Nuzhat et al. found medical students with multi-modal learning preferences achieved higher grades¹⁵. Similarly in dentistry, Aldosari et al.

found higher grades were associated with multi-modal students. According to their study findings, the students who secured GPA of 'A' preferred a quadri-modal learning style preference¹. Akhlaghi et al. in their study found that students with the read/write learning style preference achieved higher academic performances¹⁶. However, few studies suggested that some students struggled to understand a topic when their preferred mode of learning was not incorporated effectively in the teaching process^{17,18}. This prompts a teacher to use a blend of visual, auditory, reading-writing and kinesthetic aspects in the teaching process so as to enable the students with different learning preferences to learn effectively¹⁷. Furthermore, certain topics in dentistry are learnt best in a certain way only⁶. For example, biomechanical preparation of a root canal requires development of tactile sense which can be mastered only on the basis of preclinical or clinical exercises.

Number of studies that have been conducted on dental students revealed that students had a uni-modal preference for learning during their first year of undergraduate learning and they developed other preferences gradually as they progressed through the academic years^{10,19}. This could be reflective of the learning environment that changes based on the subject content delivered in different academic years in a traditional curriculum. Providing ample opportunities for all forms of learners from the first year itself might go a long way in improving the overall academic performance of the students. The existing curriculum needs to be modified to accommodate various learning preferences of the students. According to Grasha, the faculty members should develop multiple modes of instruction delivery keeping in mind the diversity of the students. This would result in gradual exposure to familiar and unfamiliar learning techniques allowing the student to ultimately excel in that topic. The importance of knowing a student's learning preference may be used to an advantage by teachers in terms of improving the learning capability who have difficulty in understanding a particular topic and who score lower grades overall. The teacher can include additional teaching strategies suitable to a particular student's preference²⁰.

The knowledge of personal learning preferences is becoming more important because of the shift of modern-day medical education from 'teacher centred' to 'student centred'. Latest curriculum involves extensive application of Problem Based Learning (PBL), Case Based Learning (CBL), remote learning and others. These modalities promote active learning as well as life-long learning²¹. It has been found that students

exposed to a variety of learning styles develop more learning skills when faced with new learning challenges. According to Dobson, students' having awareness of their own learning preferences find it easy to organize and learn course information¹⁴. The COVID-19 pandemic has resulted in a paradigm shift in the way learning is achieved²². With an increase in remote learning methodologies, the responsibility of the teacher increases while preparing their content delivery so as to allow the student to apply their preferred learning style. The use of online videos is compatible for students with visual and auditory preference, podcasts are preferred for auditory strategies, online journals for read-write method and assignments promoting the kinesthetic component of the VARK module.

There has been a dramatic change in the medical education system in recent years. The curriculum has been redesigned from teacher-centred to student-centred. Adult learners have moved from being dependent to self-directed^{23,24}. Numerous factors like age, gender, experiences, differences in learning preferences, etc., add up the complexity and challenge for the present day medical teachers. Due to these influences and demand, it has become imperative that medical educators understand how their students prefer to learn with the imperative role of teachers in developing strategies to adapt in different situations²⁵. The data in the study is limited to one university; however, inclusion of students from other universities/colleges of Nepal would provide overall learning preferences of dental students. Nevertheless, this study could be a base for re-designing an effective dental curriculum.

CONCLUSION

Realising the importance of learning preferences of individual students can help teachers to better prepare for their class. Understanding and catering to each student's individual preference may not be possible all the time but proper lesson planning and inclusion of various teaching and learning tools may help to fill this gap. This study highlighted the learning preferences of undergraduate dental students wherein majority were multi-modal thus pointing to the need of change in curriculum wherein integration of exploring learning preferences can be routinely practiced.

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