

Medical Education

Learning Preferences of Undergraduate Dental Students: A Longitudinal Assessment Over Four Years

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Abstract

Objective: To compare the learning preferences of 78 undergraduate dental students from the first to the fourth year of dental education.

Methods: The study assessed the learning sensory modality preferences of the first-year students by administering Fleming's VARK questionnaire and reassessed the same students in fourth-year, using the same questionnaire and methodology.

Results: A significant increase in the mean visual scores was observed from 2.91 ± 1.81 in the first year to 3.63 ± 2.06 in the fourth year of dental education (p-value 0.036). Also, the mean aural scores significantly increased from 4.87 ± 2.22 in the first year to 5.86 ± 2.18 in the fourth year (p-value 0.005). Although the mean read/write scores and the mean kinesthetic scores also increased over four years, yet these were not statistically significant. Additionally, a multimodal learning style was observed in 53.84% students of first-year and 51.28% students of fourth-year.

Conclusions: A significant increase in the mean visual scores and the mean aural scores of students from the first to fourth year of dental education demonstrates that learning preferences are dynamic in nature. For delivering student-centered education, educators need to be cognizant of this potential shift so that teaching strategies and resources may be modified for improved learning and student satisfaction.

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Introduction

Dental curriculum is dynamic, diverse and ever changing due to constant reforms in the curricula brought out by continuous advancements in technology regarding diagnosis and treatment.

However, students have varied individual learning preferences which affect the way they imbibe, store, recollect and finally, reproduce information.

Learning style is defined as 'the characteristic cognitive, affective, social, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment' (1). There is significant data to show that if the delivery of instruction is as per the preferred learning style, learning is enhanced (2-4). A study was conducted on the first-year students of physician assistants of Emory University, using the VARK inventory followed by a presentation on the integration of suggested study skills and classroom discussion. The study, using student feedback forms, positively reflected the benefits of VARK leading to an improvement of learning with the incorporation of study skills (4). The learning styles are known to encourage dialogue and active participation of students (5), encourage learning among students with varied learning preferences (4, 5), encourage collaboration among peers (5), and bring forth innovative and varied methods of teaching (5). If ascertained how the students learn and process information, they may become better performers (3,6).

Learning styles have been assessed using Kolb's inventory (7, 8), Gregorc Learning Style Delineator (9), VARK questionnaire (10) to name a few but the latter is the easiest to use and assess, most versatile and most extensively used in education. The learners may prefer the visual or V mode; aural or A mode; read/write or R mode and the kinesthetic or K mode.

Studies evaluating the learning preferences have observed variations regarding gender (10, 11); age (12) and cultural differences (13). Studies have also been conducted among students of schools (11), engineering (14), medical sciences (8, 15, 16), business studies (7, 17), biology (18), languages (19) and many more. However, in most cases (20, 21), an entirely different set of students was observed in first and fourth-year, and the study was in fact, cross-sectional. Very few studies were genuinely longitudinal such as those involving business students (7, 17) and dental students, the latter used Gregorc Learning Style Delineator (9).

The present study longitudinally assesses the learning preferences of the undergraduate dental students from the first to the fourth-year of dental education using the VARK questionnaire. The data thus, collected may help in analyzing any changes that may be required in the strategies and resources to complement their preferences.

Materials and Methods

The study was approved by the Ethics Committee of the Institute vide letter number PU/IEC/91/13/04/09 dated 25/10/13.

The learning preferences of the first-year undergraduate dental students were assessed by administering the VARK questionnaire (The VARK questionnaire- version 7.2) developed by Neil Fleming (22). The students were informed about the study, its objectives and assured of confidentiality. Out of one hundred students, only 83 students (17 males and 66 females) voluntarily agreed to participate and sign an informed consent. The study again assessed the learning preferences of the same students, during the fourth-year of dental course, using the same questionnaire and methodology. However, out of 83 students enrolled in the study in first-year, five students did not respond in fourth-year and were hence, excluded from the study. Hence, only 78 students (17 males and 61 females) of first-year, who followed up till fourth-year were evaluated.

The VARK questionnaire-version 7.2 consists of sixteen questions with four options marked A, B, C and D. Students were instructed to opt for one or more answers which best explained their learning preference. The students even had the option of leaving a question unanswered. The completed questionnaires were scored and analyzed using the stepping-stone method provided in the VARK website at www.vark-learn.com (23). Depending upon the preferred sensory modality of learning, the students were divided into two broad groups: unimodal (preference for one mode- either V, A, R, or K) and multimodal (having preference for more than one mode). The multimodal group included bimodal (a combination of any two modes; VA, VR, VK etc); trimodal (a combination of any three modes-VAR,

VRK, VAK etc.); and quadmodal preferences (all four sensory modes-VARK).

The percentage of students in each group was calculated. The mean VARK scores of students for the first year and fourth year were calculated and compared. Non-parametric Mann-Whitney *U*-test was used for statistical analysis of two groups. For categorical data, comparisons were made by Pearson Chi-square test. All the statistical tests were two-sided and were performed at a significance level of $\alpha=.05$. The analysis was conducted using IBM SPSS for Windows (version 22.0; SPSS Inc., Chicago, IL, USA).

Results

A comparison of the mean VARK scores, employing Mann-Whitney *U* test, showed a significant increase in the mean visual scores from 2.91 ± 1.81 in the first year to 3.63 ± 2.06 in the fourth year (p-value 0.036) and the mean aural scores from 4.87 ± 2.22 in the first year to 5.86 ± 2.18 in the fourth year (p-value 0.005, Figure 1). Although the R scores also increased from 3.69 ± 2.22 in first-year to 4.51 ± 2.48 in fourth-year, yet

the difference was not statistically significant (p-value 0.051). The K scores increased from 5.96 ± 2.13 in first-year to 6.68 ± 2.67 over four years and the result was statistically non-significant (p-value 0.057).

The results of 78 dental students of first-year showed that the percentage of students preferring unimodal learning style were not significantly different in the first and fourth year (46.15% to 48.72%, p-value 0.908). The preferred unimodal learning was in the order K, A, R and V. Among the unimodal students, the percentage of students preferring the visual mode increased from 1.28% to 3.85% and aural mode increased from 10.26% to 16.67% respectively over four years (p-values 0.317 and 0.275 respectively). There was no change in the number of students preferring the R or read/write mode (6.41%, p-value 1.000). However, the number of students preferring K or kinesthetic mode decreased from 28.21% to 21.79% (p-value 0.423).

The percentage of students preferring multimodal learning styles were also not significantly different in the first and fourth year (53.84% to 51.28%, p-value 0.873). The bimodal students increased from 26.92% to 29.49% (p-value 0.647), trimodal

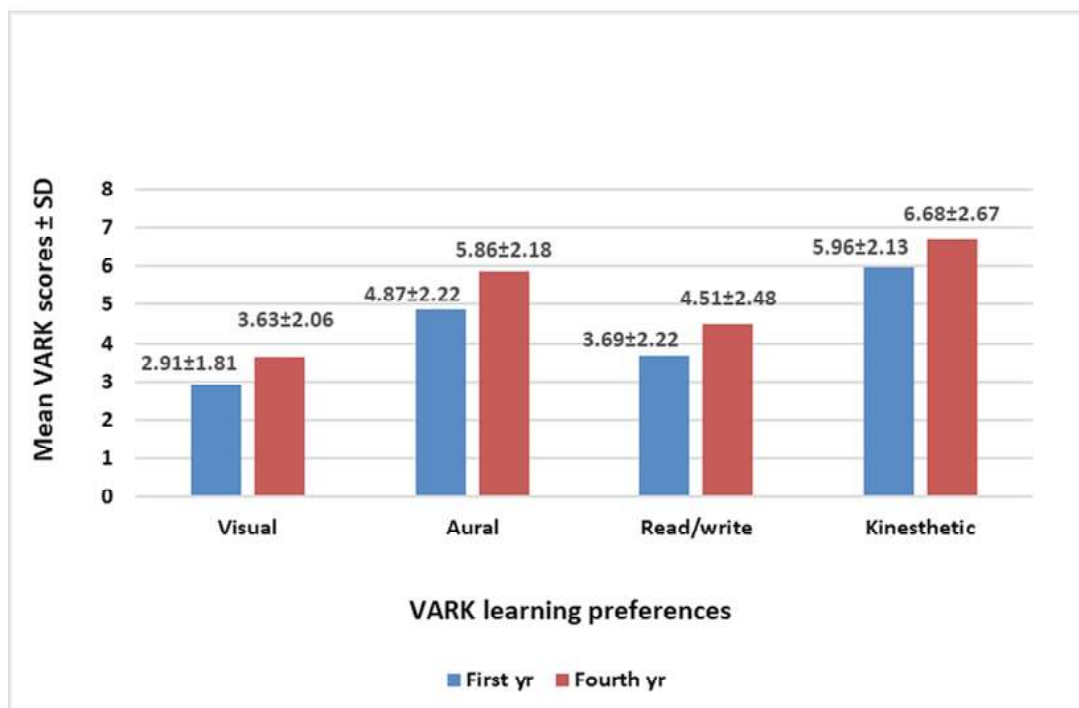


Fig. 1: A comparison of the mean VARK scores over four years of dental education.

TABLE I: A comparison of the number of students with a unimodal and multimodal learning style over four years of dental course.

Preferred mode of learning style		First year	Fourth year	p-value	
		Student % (n)	Student % (n)		
Unimodal	V	1.28 (1)	3.85 (3)	0.317	
	A	10.26 (8)	16.67 (13)	0.275	
	R	6.41 (5)	6.41 (5)	1.000	
	K	28.21 (22)	21.79 (17)	0.423	
	Total unimodal	46.15 (36)	48.72 (38)	0.908	
Multimodal	Bimodal	VA	1.28 (1)	0	
		VR	1.28 (1)	0	
		VK	2.56 (2)	2.56 (2)	1.000
		AR	1.28 (1)	1.28 (1)	1.000
		AK	15.38 (12)	20.51 (16)	0.45
		RK	5.13 (4)	5.13 (4)	1.000
	Total bimodal	26.92 (21)	29.49 (23)	0.647	
	Trimodal	VAR	0	0	
		VRK	0	1.28 (1)	
		VAK	5.13 (4)	1.28 (1)	0.180
		ARK	7.69 (6)	5.13 (4)	0.527
	Total trimodal	12.82 (10)	7.69 (6)	0.467	
	Quad modal	VARK	14.1 (11)	14.1 (11)	1.000
Total multimodal	53.84 (42)	51.28 (40)	0.873		

decreased from 12.82% to 7.69% (p-value 0.467) and quadmodal remained unchanged over four years of dental course (14.1%, p-value 1.000).

A longitudinal assessment of the bimodal students showed an insignificant increase in preference for the AK mode from 15.38% to 20.51% [p-value 0.450, Table I]. Students preferring VK, AR and RK remained unchanged in fourth-year at 2.56%, 1.28% and 5.13% respectively (p-value 1.000). Also, there was an insignificant decrease for the VA and VR mode.

Additionally, among the trimodal students [Table I], those preferring VAK and ARK decreased from 5.13% to 1.28% and 7.69% to 5.13% respectively (p-values 0.180 and 0.527 respectively). Although an increase was observed in VRK, yet the result was statistically non-significant.

Discussion

Learning styles determine how an individual takes in and processes information. Four different learning style models exist namely the personality model, the social interaction model, instructional preference

model and information-processing model (24). The VARK learning inventory is a type of instructional preference model which assesses the student's learning preference for visual, aural, read/write and kinesthetic modalities.

In the present study, a multimodal learning style was observed in 53.84% students of the first year and 51.28% students of the fourth year. Similar studies conducted on dental students using the VARK inventory have observed 48%-59% students with a preferred multimodal learning style (10, 21, 25-27).

Learning preferences may or may not change over time and the data is conflicting. In the present study, no significant change was observed in the number of students preferring multimodal or unimodal learning style over four years of dental curriculum. The results are comparable to a study wherein when the learning styles of undergraduate medical students were assessed using VARK and ASSIST (The Approaches to Study Skills Inventory for Students) questionnaires, the results showed that 69.9% had a multimodal learning preference in the first year which changed to 67.5% in the final year (28). However, results of

the present study differ from a longitudinal, VAK questionnaire-based study on undergraduate medical students where a unimodal learning style in first-year (62.31%) changed to a multimodal preference in the final year (52.26%) (16). An assessment of the learning styles of undergraduate students using other learning inventories such as Kolb's Learning Style Inventory (8) and Gregorc Learning Style Delineator (9) have shown that the learning styles may change over time. In the present study, the possible reason for an insignificant transition from first to the fourth year of dental course, could be partly explained by the fact that there is an adequate hands-on training imparted in anatomical dissection, pre-clinical training on manikins and in basic sciences involving spirometry, sphygmomanometry, hematology, pharmacology and pathology practical work. In subsequent years of dental curriculum, there is also an exposure to clinical work in both medical and dental subjects apart from dental laboratory work related to patient care. Teaching styles, type of curricula, learning preference and other individual differences may account for variations from the above studies.

The present study also observed that among the unimodal group, the kinesthetic learners were more (28.21%) followed by the aural learners (10.26%) in first-year with a similar trend in fourth year (21.79% and 16.67% respectively). Similar findings were observed in studies conducted by other investigators on dental students (21, 27, 29). Still others have observed a predominant read/write followed by the visual mode (25) and an aural followed by the kinesthetic mode among unimodal dental students (30). The predominant kinesthetic unimodal preference in the present study as compared to other studies could be due to individual differences such as age, gender, previous education system in schools, upbringing, personality, social and cultural background of the students or attributed to the effect of differences in teaching methods, preclinical training and varied curricula apart to name a few.

The significant increase in the mean visual scores and the mean aural scores observed in the present study contrasts with a study where no significant difference was observed when the three learning

styles (VAK) were compared over the years (16). A similar study on dental students showed no significant change in the mean VARK scores in the first and second year (27). In the present study, a significant increase in the mean aural scores could partly be due to an increased academic load in fourth-year resulting in greater didactics. Learning through aural lectures has been the traditional mode of learning where rote memorization is taught to the students right from schools. Also, the selection criterion for admission to the institute is based solely on a national level theoretical entrance examination which makes learning through memorizing an indelible and ingrained part of learning over the years. The possibility that a considerable number of students are from various states and hostel inmates remain high. Growing up, studying and learning together in the hostels further encourage group discussions. Moreover, regular assignments, tutorials and seminars encourage learning through the aural mode. The active participation, question-answer sessions, discussions and recall of previous lectures in subsequent classes could also have contributed to the increased aural scores. Additionally, clinical postings, in both medical and dental subjects, involve patient interaction where chairside group discussions are common.

The present study also observed a significant increase in the visual scores of students over the years. With the ever-expanding syllabi of dentistry, learning has become exhaustive which could have encouraged students to adopt to simplified learning using flowcharts, labelled diagrams and highlighting or underlining the text.

The process of learning is complex. A vast array of factors such as previous education taught in schools, differences in dental teaching methods and training world over, aptitude, intelligence, curiosity/fascination or disinterest for a subject, socioeconomic status, social and cultural background greatly influence learning. Also, exposure to external variables such as modeling or observation of tasks, focus or concentration of the learner, attributes of the model (attractiveness or method/style of teaching), student-teacher relationship and influence of the peer group affect learning to a great extent. So, to accommodate

these individual learning variations, a multimodal approach of teaching, employing diverse and integrated approaches, would be beneficial to a wide array of phenotypically, emotionally, socioeconomically and culturally diverse students in a class. Educators are encouraged to adopt different methods of teaching involving seminars, active participations, demonstrations, instructor-driven group discussions, simulations and web-based learning to inculcate interest.

The mere preference of a student for learning neither implies that he/she is lacking in others nor that if taught in a non-preferred style, hampers the learning process (31). However, it just leads to a better understanding and subsequently, more retention of information. VARK should not be considered the sole criterion for assessing the learning preference or to deliver instructions in a particular manner but rather, solely as one of the criteria involved in the complexity of learning.

The strength lies in the longitudinal nature of the present study which evaluates the students' learning preferences over time so that information delivery could be adopted to their needs. The present research also has few limitations. The study is a single centric study (single institute of a single city) and needs to be conducted on a larger sample size and a wider scale. Secondly, it needs to be conducted in institutes where different methods of undergraduate teaching are employed.

Further research could be conducted to know if a correlation exists between the learning preferences of students and classroom attendance and/or academic performance. Secondly, with the advent of different curricula in dental education, such studies can be conducted to ascertain if the type of curricula has any effect on the learning preferences of students.

Conclusion

A significant increase in the mean visual scores and the mean aural scores from the first to the fourth year of dental course was observed. The educators must be cognizant of the differences that may exist in the learning preferences of students and adopt varied and integrated approaches of teaching to make it more assimilating and retentive.

Conflict of interest

The authors declare that they have no conflict of interest.

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