


Preferred Learning Styles of Dental Students in Madinah, Saudi Arabia: Bridging the Gender Gap

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Purpose: Currently, the dental education system in Saudi Arabia is gender segregated. It is important to find out whether teaching methods must be altered to improve the learning experience for both genders throughout their years of study. This study aims to investigate the preferred learning styles for males and females studying dentistry at Taibah University, Madinah, Saudi Arabia and the effect of academic level on the learning style preference.

Materials and Methods: A cross-sectional survey composed of the visual, aural, read/write, kinesthetic (VARK) questionnaire was distributed to 228 undergraduate dental students at Taibah University through emails during September/October 2020. Student learning styles were presented using descriptive statistics. Learning preferences between genders and academic years were compared using independent proportional *t*-test and Chi-square test.

Results: A total of 168 dental students completed the questionnaire. Both genders displayed a higher percentage of a unimodal learning preference (60% males, 50% females) with 41% of males preferring the kinesthetic learning style, followed by the aural (26%) then the visual (20%), and lastly read/write learning style (12.6%). Female students preferred the kinesthetic learning style (42%), followed by the visual (27%) then the aural (20%), and lastly read/write learning style (11%). All students throughout the 6 academic years preferred the unimodal learning approach with the kinesthetic style favored. The quadmodal was preferred mostly by interns.

Conclusion: Both male and female students studying dentistry at Taibah University had a unimodal learning preference. Quadmodal learning was popular among interns. Both genders preferred the kinesthetic learning style, followed by the aural for males and visual for females. Teaching methods must be tailored to suit the learning style of each gender to promote motivation and thriving for a successful outcome.

Keywords: dental education, gender difference, Saudi Arabia, learning styles, VARK questionnaire, learning preference

Introduction

Gender differences in educational attainment at primary and secondary education level have been long standing and are well documented in the literature.¹ A significant number of single sex schools are available in Ireland, Australia, and New Zealand. More numbers of single sex schools are being introduced in the UK and USA, more commonly single sex class rooms in coeducational schools.² This was promoted in response to many reasons namely boys underachievement, to provide space for girls and to improve their self-confidence. It also allows girls and boys to choose subjects not related to their gender. And most importantly, this allows teachers to use certain classroom strategies that might be more suited to one gender than the other.³

Gender difference in educational achievement may be attributed to biological differences between males and females.⁴ It was proposed that gender differences in cognitive abilities, skills, and behaviour are determined by biological factors such as brain organisation, genetics and hormones which have an influence on the behaviour and abilities of each gender, hence affecting educational achievement.⁵ For example, it was reported that males are better in controlling visual images in working memory while females are better in retrieving from long-term memory and obtaining and using verbal information and spelling.^{6,7} Although this difference in brain structure and function between the genders is correlated with performance and achievement, it is not purely biologically determined but is a result of a mixture of a socially mediated event with a biological basis.⁷

Higher education is a coeducational system in western countries and most existing research studies have tackled the issue of gender equity in higher education but rarely the actual effect of gender differences in learning styles of students and whether this may alter the teaching methods used.⁸

The quality of dental undergraduate education is vital so that the students are prepared for their future careers. As educators, different methods need to be found to expand the quality of education in order to improve student learning, engagement, and motivation. One way of improving the student's performance is by understanding the different learning styles which the students engage and to adapt different teaching approaches that meet these styles of learning.⁹ Various ranges of models and theoretical approaches for understanding student learning in the context of higher education have been suggested and described by Dunn and Dunn, Felder-Silverman, Salmes, Honey and Mumford, and Kolb.^{10–13} However, basically they can be divided into “deep” and “surface” learning approaches based on the original work of Marton and Säljö in the 1970's.¹⁴ The emphasis has been focused on considering the student as an individual by attempting to understand how students attain data and relate it to the existing knowledge, how the knowledge is processed to obtain understanding, and the ways the students exhibit what they learn.¹⁵

The VARK model originally developed by New Zealand educator Neil Fleming in 1998 identifies four learning styles based on the neural system with which an individual prefers to obtain information: Visual (V), Aural (A), Read/Write (R), and Kinesthetic (K). Although an individual may learn by all these sensory types, one type would often be favored and more dominant.¹⁶ An individual considered to be a visual (V) type of learner obtains and retains information by looking at images, figures, graphics, and videos. Aural learners (A) prefer to listen and can retain information by reading aloud or subvocalization. Therefore, they prefer listening to lectures, seminars, or discussions. Individuals preferring the Read/Write (R) style of learning favour reading to gain information. In this case, text books, handouts, or lecture notes are useful. Individuals who are kinesthetic (K) learners prefer interaction to help them understand and application of what they learned. They benefit most from hands on approaches, practical application, trial and error, and real life experience.¹⁷ The VARK model is a popular model used to assess student learning styles in the health science field.^{9,18–23} It has established validity and reliability and is brief, easy, and fast to complete.²⁴

Although it is well documented that students are diverse in their learning style preferences, it is unclear whether gender differences exist in learning style preferences among dental undergraduate students. This is particularly important in Saudi Arabia where the Saudi education system including higher education is largely affected by society, culture, and religion. One way this is portrayed can be seen in the form of gender segregation and therefore understanding the most effective teaching approaches for each gender is essential. It would be significant to know if males learn differently than females especially in Madinah which lies in the Western region of Saudi Arabia where the effect of gender difference on the learning styles of dental students has not been studied before.

Therefore, this study aims to investigate the learning styles for both males and females studying dentistry at Taibah University in Madinah, Saudi Arabia and the effect of academic level on the learning style preference to find out whether teaching methods must be altered to improve the learning experience for both genders throughout their years of study.

Materials and Methods

A cross-sectional survey using the VARK questionnaire version 8.0 was used in the study. The study was reviewed and approved by the Taibah University College of Dentistry Research Ethics Committee (TUCDREC/20200311). There are a total of 320 students enrolled at the Dental College at Taibah University, Madinah, Saudi Arabia for the academic year 2020–2021. Sample size was determined at $\alpha=0.05$ with power 0.92 and effect size = 0.1. Based on this, the total sample size was calculated to be $n=228$ (114 female and 114 male) with $n=38$ from each education level (19 female and 19 male) using equal stratified sampling technique with 6 strata (2nd year-interns), male and female.

The questionnaire was distributed randomly through emails during Sept/Oct 2020. Each e-mail explained the study and included a survey link on Google Forms. Participation was voluntary, and completing the questionnaire was indication of consent. The questionnaire included 16 multiple-choice questions, with four choices each. Students were asked to select multiple responses if more than one choice was appropriate. The guidelines presented in the VARK website were used to calculate the distribution of the VARK preferences. These were classified as unimodal (V, A, R, or K), bimodal (VA, VR, VK, AR, AK, and RK), trimodal (VAR, VAK, VRK, and ARK), or quadmodal (VARK).

Statistical Analysis

Descriptive statistics including mean, standard deviation, frequency, tables and graphs were used for presentation of the data. However, for statistical inference comparing the association between groups, proportional independent *t*-test and chi-square test were used. Level of significance was set at 0.05 ($\alpha=0.05$). Data was collected and entered using IBM-SPSS version 25 for analysis.

Results

There were a total of 168 responses out of 228 which represents a response rate of 73.6%. Out of these responses, 48.8% were male and 51.2% were female. Distribution of the responses according to the year of study are as follows: 10.1% in the second year, 13.7% in the third year, 21.4% in the fourth year, 19% in the fifth year, 21.4% in the sixth year, 14.3% interns (graduates completing a last year of training). Regarding the overall distribution of VARK, female students seemed to prefer the kinesthetic style of learning ($n=843$) followed by visual ($n=613$) then aural ($n=507$) and lastly read/write ($n=323$). Similarly, male students also preferred the kinesthetic style of learning ($n=735$), followed by the aural style of learning ($n=542$) then visual ($n=442$) and lastly read/write ($n=297$). Although both genders preferred the kinesthetic style of learning (36.7%), there were statistically significant difference between males and females for both the kinesthetic and visual learning styles (Table 1 and Figure 1).

Both genders displayed a higher percentage of a unimodal learning preference (60% males, 50% females), followed by a bimodal learning preference (31% males, 35% females), then the trimodal learning preference (7.5% males, 12% females), with the quadmodal learning preference having the lowest percentage for both genders (2% males, 3% females). There was a statistically significant difference between all levels of learning style modalities between both genders as displayed in Table 2. Regarding male students with a unimodal preference, 41% preferred the kinesthetic learning style, followed by the aural (26%) then the visual (20%), and lastly read/write learning style (12.6%). With regards to the female students, 42% preferred the kinesthetic learning style, followed by the visual (27%) then the aural (20%), and lastly read/write learning style (11%).

Those who had a bimodal learning preference favoured the AK (aural, kinesthetic) for males (31.6%) and the VK (visual, kinesthetic) for females (35.5%) while the least preferred bimodal learning style was the VR (visual, read/write) style for males (7.4%) and the AR (aural, read/write) style for females (6.5%).

Regarding the trimodal learning preference, VAK (visual, aural, kinesthetic) was the most dominant for both male and female students (38%, 42%) respectively, while the VAR (visual, aural, read/write) was the least preferred trimodal learning style for both genders (9% males, 8% females) (Table 2 and Figure 2).

Distribution of the VARK learning style between students in the 6 academic years including the internship year of training is displayed in Table 3. All students throughout the 6 academic years preferred the unimodal learning approach with the kinesthetic style to be the favored learning style consistently throughout the academic years. The VK (visual, kinesthetic) style was the most preferred bimodal learning style for students in all academic years. While the VAK (visual, aural, kinesthetic) learning style was the most preferred trimodal learning style for students in all academic years except interns. Interns preferred the VRK (visual, read/write, kinesthetic) learning style. The quadmodal was preferred mostly by interns.

Table 1 Overall Distribution of VARK

Level	Gender				Total		P-value
	Male		Female				
	n	%	n	%	n	%	
V	442	42	613	58	1055	24.5	0.000
A	542	52	507	48	1049	24.4	0.126
R	297	48	323	52	620	14.4	0.140
K	735	47	843	53	1578	36.7	0.000

VARK by Gender

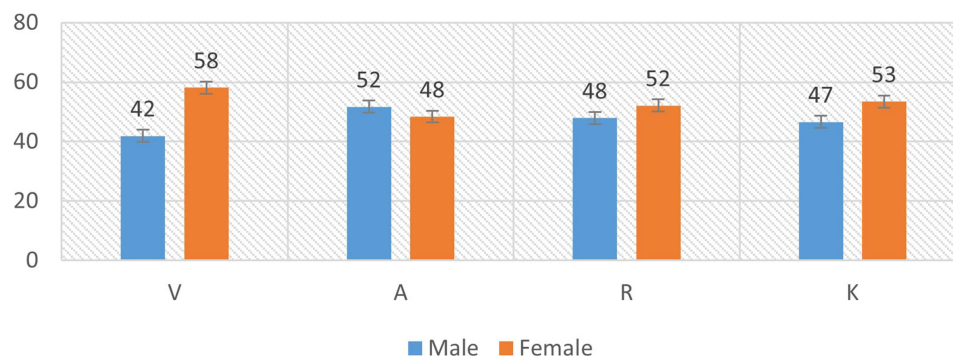


Figure 1 Overall distribution of VARK between gender.

Discussion

In this study, both genders displayed a higher preference of unimodal learning, followed by bimodal, trimodal, and lastly quadmodal learning. There were statistically significant differences between the unimodal and multimodal learning

Table 2 Unimodal and Multimodal VARK Distribution by Gender

VARK	Gender		Total	P-value
	Male	Female		
V	157 (20%)	184 (27%)	341 (23.2%)	0.039
A	206 (26%)	138 (20%)	344 (23.4%)	0.000
R	99 (12.6%)	76 (11%)	175 (12%)	0.014
K	321 (41%)	286 (42%)	607 (41%)	0.045
Total unimodal	783 (60%)	684 (50%)	1467	0.045
VA	69 (17%)	71 (15%)	140 (16%)	0.811
VR	30 (7.4%)	36 (7.5%)	66 (7.5%)	0.296
VK	96 (24%)	169 (35.5%)	265 (30%)	0.000
AR	34 (8.4%)	31 (6.5%)	65 (7%)	0.599
AK	128 (31.6%)	119 (25%)	247 (28%)	0.418
RK	47 (11.6%)	50 (10.5%)	97 (11%)	0.667
Total bimodal	404 (31%)	476 (35%)	880	0.001
VAR	9 (9%)	13 (8%)	22 (8%)	0.228
VAK	38 (38%)	69 (42%)	107 (41%)	0.000
VRK	20 (20%)	53 (32.5%)	73 (28%)	0.000
ARK	32 (32%)	28 (17%)	60 (23%)	0.465
Total trimodal	99 (7.5%)	163 (12%)	262	0.000
VARK	26 (2%)	37 (3%)	63	0.050
Total	1312	1360	1312	0.189

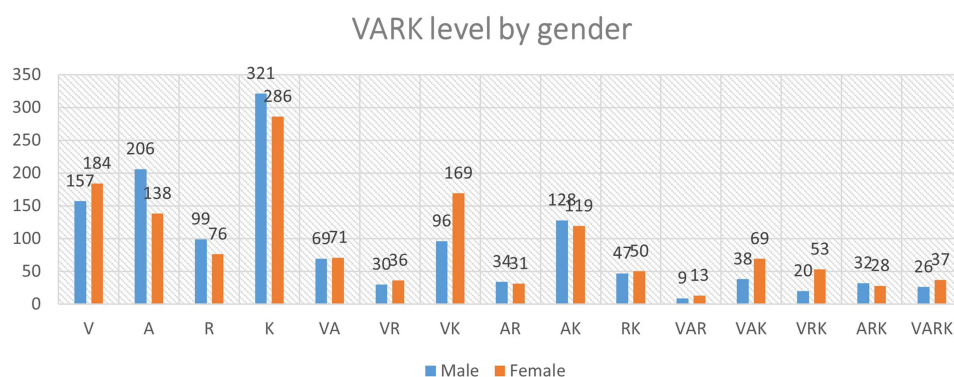


Figure 2 Unimodal and multimodal VARK learning distribution by gender.

preference between both genders, where more males preferred the unimodal learning style while more females had a multimodal learning preference. Preference for a unimodal learning style was confirmed in the study by Siddiqi et al who distributed the VARK questionnaire to first and second year dental students at Islamabad Dental College and found that 52% of the students were unimodal, 36% were bimodal, 8% trimodal, and 4% were quadmodal.²⁵ Furthermore, another study implemented on first to third year medical and dental students at the Islamic International Medical and Dental College in Pakistan yielded similar results with the majority preferring a unimodal learning style.²⁶ These findings are in contrast to the study conducted by Aldosari et al where more than half of the students studying dentistry at King Saud University had a multimodal learning preference. However females did demonstrate a higher preference to the bimodal learning style compared to males which is similar to the findings of this study.²⁷ Similarly, another study conducted at King Saudi University by Al-Saud found that multimodal learning preferences was dominant in first year

Table 3 VARK Distribution by Year of Study

VARK	Second Year	Third Year	Fourth Year	Fifth Year	Sixth Year	Intern	P-value
V	48	52	71	69	74	27	0.000
A	52	36	74	63	93	26	0.000
R	13	30	23	49	38	22	0.000
K	65	75	130	123	156	58	0.000
VA	8	24	33	19	29	27	0.000
VR	9	1	9	10	14	23	0.000
VK	25	43	69	48	47	33	0.000
AR	2	5	14	26	10	8	0.000
AK	18	40	53	45	51	40	0.000
RK	7	5	17	18	20	30	0.000
VAR	2	2	6	2	3	7	0.013
VAK	11	24	29	12	16	15	0.000
VRK	5	3	27	10	11	17	0.000
ARK	3	6	20	11	7	13	0.001
VARK	4	6	17	7	7	22	0.000

dental students; however, differences in learning style preferences between male and female first year dental students were detected albeit not statistically significant. Most of male students favoured unimodal learning, whereas more female students had a multimodal learning style.²⁸ Another study at Wayne State University School of Medicine found no difference in learning styles between genders; however, these were applied to first year dental and medical students only in contrast to including students in all academic years which may have yielded a different result.^{28,29} These difference in learning styles may be attributed to differences in age, culture, and academic level of the students participating in these studies.³⁰

The kinesthetic learning style was highly preferred for both unimodal and multimodal learning approaches for both genders. This is not surprising as training in dentistry involves a hands-on approach with practical sessions, use of models and simulation, and real life experience in the form of training and practice on real patients. This is in line with previous studies where the kinesthetic learning style is the preferred learning style for students in dentistry and similar specialties.^{25,26,30,31} The most preferred learning style after kinesthetic was the aural for males and visual for females. Indeed this finding is compatible with the data reported by Asiri who investigated the learning style preference of dental undergraduate male students at King Saud University and found that 35.1% of the students preferred the kinesthetic learning style and 35.1% preferred the aural.³⁰ Similarly, the study by Al-Saud showed that aural and kinesthetic learning styles were favoured among students with a preference for a single mode style of learning.²⁸ This was also confirmed in the study by Siddiqi et al.²⁵ This difference in learning style between males and females is particularly important when planning teaching sessions and preparing teaching materials that suit both genders. Focus should be made on discussions and tutorials to accommodate the aural learning preference for males, and teaching strategies using diagrams and flowcharts should be focused for females to accommodate their visual learning preference as an example among many.

The read/write learning style was the least preferred for both genders at all modality levels. This is in agreement with many studies where the read/write learning style was one of the least preferred learning approach for medical and dental students.^{28,30,31}

As the dental curriculum shifts from primarily lectures in the first and second years of dental training to a more hands on approach in the form of pre-clinical and clinical training during the later years, preferences for some students may change to accommodate and master the new learning objectives.¹⁸ In this study, all students throughout the academic levels preferred an unimodal learning approach with the kinesthetic style favored consistently, indicating no change in learning styles to accommodate new learning objectives. This may suggest that students with kinesthetic learning preference may tend to choose to study dentistry as this discipline appeals to them.

The quadmodal learning style was preferred mostly by interns compared to students in their early years of dental training. This may be that senior students are more competent and hence may use all their senses to take in information at any given time.²⁹ In the study by Asiry, no differences in learning styles was found among male students studying dentistry from the first to the final year.³⁰ Similarly, Aldosari et al found no significant difference in learning style preference among dental students throughout the academic years.²⁷

Assessing learning styles of undergraduate dental students and identifying gender differences in learning is of fundamental importance as this will allow evaluation of the current teaching methods. Improving and adapting the teaching methods so that it suits the learning style and needs of students is essential for improving the quality of the learning experience for the dental students. Although a growing number of recent studies assessing the learning styles of students in higher education find no significant difference in learning styles when assessing gender as a variable, this study found a significant difference. This may be due to differences in number of participants involved in different studies. Over recent years, Saudi Arabia like other parts of the world has witnessed gender differences in higher education which were not apparent in the past.³² Female students now not only outnumber male students but also outperform them academically.³² More female students are choosing courses which previously were more popular with male students. Additionally, females perceive higher education more seriously than males.³³ This may be attributed to a change in the views, priorities, break from tradition, and learning behaviour between genders in higher education.

Conclusion

Both male and female students studying dentistry at Taibah University had a unimodal learning preference. Quadmodal learning preference was more popular among interns. Both genders preferred the kinesthetic learning style most, followed by the aural learning style for males and visual learning style for females. The findings of this study could help increase the awareness of dental faculty members to the importance of the effect of student learning styles, the significance of planning teaching sessions, and the influence of their own teaching style which should be planned to suit all students. This is important for creating a learning environment suited for everyone, to promote motivation and thriving for a successful outcome.

Disclosure

The author reports no conflicts of interest in this work.

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