Learning Style Preferences of First-Year Dental Students at King Saud University in Riyadh, Saudi Arabia: Influence of Gender and GPA

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Abstract: The aim of this study was to investigate the learning style preferences of a group of first-year dental students and their relation to gender and past academic performance. A total of 113 first-year dental students (forty-two female, seventy-one male) at King Saud University in Riyadh, Saudi Arabia, participated. The Visual, Aural, Read-write, and Kinesthetic (VARK) questionnaire was used to determine the students' preferred mode of learning. This sixteen-item questionnaire defines preference of learning based on the sensory modalities: visual, aural, reading/writing, and kinesthetic. More than half (59 percent) of the students were found to have multimodal learning preferences. The most common single learning preferences were aural (20 percent) followed by kinesthetic (15.2 percent). Gender differences were not statistically significant. However, a statistically significant difference was found in the mean values of GPA in relation to the students' learning style preferences (p=0.019). Students with a single learning style preference had a lower mean GPA than those with multiple (quad-modal) learning style preferences. For effective instruction, dental educators need to broaden their range of presentation styles to help create more positive and effective learning environments for all students.

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In the past three decades, the proposition that students learn and study in different ways has emerged as a prominent pedagogical issue. Students differ in the types of instruction to which they respond best (learning style preferences), the ways they approach their studies (orientations to studying and approaches to learning), and their attitudes about the nature of knowledge and their role in constructing it—that is, their levels of intellectual development. A learning style describes a process or preference and is considered an umbrella term covering a spectrum of modalities, preferences, and strategies. James and Gardner defined learning preferences as the manner in which, and the conditions under which, learners most efficiently and effectively perceive, process, store, and recall what they are attempting to learn. Learning preference is considered a component of the wider concept of personality. One learning style is neither preferable nor inferior to another but is simply different, with different characteristic strengths and weaknesses.

In the pedagogical triangle of teacher, students, and study subjects, the learning style approach trains professionals to focus on how their students learn or fail to learn. Knowledge of learning styles can be used to increase the self-awareness of students and tutors about their strengths and weaknesses as learners. It has been proposed that the ability to typify students' learning styles can augment the educational experience. Students with knowledge of their own learning preferences are empowered to use various techniques to enhance their learning, which, in turn, may impact their overall educational satisfaction. Moreover, the logic of lifelong learning suggests that students will become more motivated to learn by knowing more about their own strengths and weaknesses as learners. In turn, if teachers can respond to each individual’s strengths and weaknesses, then retention and achievement rates in formal programs are likely to rise and “learning to learn” skills may provide a foundation for lifelong learning.

Various models have been developed to explain the different learning styles. These models can be grouped into four general categories: personality models, information-processing models, social-interaction models, and instructional preferences models.
Among the instruments/inventories in the category of instructional preferences is the Visual, Aural, Read-write, and Kinesthetic (VARK) questionnaire developed by New Zealand educator Neil Fleming.\textsuperscript{1,8} VARK is a short, simple questionnaire designed to help students learn more effectively and to help faculty members become more sensitive to the diversity of teaching strategies necessary to reach all students.\textsuperscript{9}

The VARK instrument defines the learning preference based on the sensory modality in which a student prefers to take in new information. The three major sensory modalities are visual (V), aural (A), and kinesthetic (K), which are collectively known as VAK. Fleming expanded this classification system to VARK to include read-write (R, a mixed sensory modality that is not assessed under VAK).\textsuperscript{10} Visual learners prefer the use of diagrams, flow charts, hierarchies, models, and arrows that represent printed information. Auditory learners prefer “heard” information and thus enjoy discussions, lectures, and tutorials when acquiring new information. Read-write learners prefer printed words and texts as a means of information intake; they also prefer lists, glossaries, textbooks, lecture notes, or handouts.\textsuperscript{11} Finally, kinesthetic learners internalize information best when they are involved physically (e.g., touching and manipulating materials).\textsuperscript{12} They prefer simulations of real practices and experiences, field trips, exhibits, samples, photographs, case studies, real-life examples, roleplaying, and applications to help them understand principles and advanced concepts.\textsuperscript{13} Students may have one or multiple learning preferences.

The VARK questionnaire is not intended to box respondents into a mindset that they have been diagnosed or labeled. Rather, it is designed to initiate discussions about, and reflections upon, learning preferences.\textsuperscript{9} Ensuing discussions about the questionnaire results may help create a sense of self-awareness for the student as to how he or she learns best and the motivation to seek out the best methods to improve learning performance.\textsuperscript{13} Many factors have been found to influence students’ learning styles, including gender, age, academic achievement, brain processing, culture, and creative thinking.\textsuperscript{14} A number of studies have examined the influence of gender and grade point average (GPA) on learning style preferences among students in various disciplines.\textsuperscript{15,19} Previous academic performance has often been used as a predictor of future academic success, and GPA continues to be the single best predictor for adults of diverse backgrounds.\textsuperscript{20} Gender-based preference in learning style is one area in which males and females are unique.\textsuperscript{16} Slater et al. reported some gender differences in preferred methods of information delivery among first-year medical students and suggested that the female student population is more diverse than the male population, encompassing a broader range of sensory modality preferences.\textsuperscript{17}

In the medical and dental literature, learning style preferences have been investigated by many authors using the VARK instrument. Murphy et al.\textsuperscript{13} studied the learning style preferences of predoctoral dental students, as well as the differences among classes and gender and compared it to a sample population of 31,243 participants on the VARK website. A study by Kaczmarek et al.\textsuperscript{21} investigated the learning style preferences of Polish undergraduate dental students using the VARK inventory. El Tantawi\textsuperscript{10} investigated factors that influence postgraduate dental students’ performance in a biostatistics and research design course, among which was learning style preferences.

The preferred learning styles of Saudi undergraduate medical students were investigated recently by Nuzhat et al.\textsuperscript{14} However, there have been no previous studies on learning style preferences of Saudi dental students and whether these preferences are influenced by such factors as gender and GPA. Therefore, the aim of this study was to investigate the learning style preferences of first-year dental students in a single academic institution (King Saud University) in Riyadh, Saudi Arabia, using the Arabic version (version 7) of the VARK questionnaire and to determine the association between learning style preferences and gender and between learning style preferences and past academic performance of students represented by their GPA in the preparatory year.

### Methods

This descriptive cross-sectional study was conducted at the College of Dentistry, King Saud University in Riyadh, Saudi Arabia. A total of 113 first-year dental students (forty-two female and seventy-one male) participated voluntarily in the study. The study was approved by the Ethical Subcommittee of the College of Dentistry Research Center, King Saud University. The participating students were fully aware of the purpose of the study as it was explained in the cover letter, and they were told that the information given would be used for research purposes only. In addition, it was clearly stated that
participation was voluntary and would not affect students’ course grade.

The Arabic version (version 7) of the VARK questionnaire was used; it is available for free download at the VARK website\(^{22}\) with instructions for analysis and suggestions for improving the learning experiences of students according to their learning style preference. The questionnaire consisted of sixteen multiple-choice questions, each with four options. Each question aims to place the respondents in a “learning situation.”\(^{11}\) The questionnaire uses observations of behaviors: concrete incidents that respondents can recall or imagine and identify with. In that sense, the VARK is indicative rather than diagnostic, and it focuses on only one of many elements of a learning style.\(^{22}\) The VARK instrument was selected because it is concise and quick to complete and it provides useful information for students about their learning preferences.\(^{13}\) Satisfactory levels of reliability and validity of the VARK have been reported using factor analysis techniques, although potential problems related to item wording and the scale’s scoring algorithms have been identified.\(^{24}\)

The questionnaire was distributed to all first-year dental students in both male and female university campuses at the beginning of the first academic semester. The students were asked to complete the questionnaire and return it to the investigator. Instructions for answering the questionnaire were provided to the students. Each questionnaire was given a serial number that can be saved by the student for future reference and discussion about his or her learning style. A cover letter was added to the questionnaire by the investigator to explain the purpose of the study. It also included questions about gender and the GPA of the student in the preparatory year.

In Saudi Arabia, the GPA scale in most universities including King Saud University (KSA) is a five-point scale (King Fahd University of Petroleum & Minerals and UMM Al-Qura University use a four-point scale). University admissions at KSA now require the General Aptitude Test (GAT) (Qudrat) and Standard Achievement Admission Test (SAAT) of the National Center for Assessment in Higher Education (QIYAS).\(^{23}\) After admission, students start the preparatory year program. In the preparatory year (predental) at King Saud University, teaching is focused on English language, mathematics, computer, and self-development skills. One month later, the students who were interested in knowing about their learning styles were provided with the learning style results along with general information about basic learning styles with suggested study strategies from the VARK website.

After data collection, the distributions of VARK preferences were calculated, and the learning style of each student was determined using the stepping-stone method explained on the VARK website.\(^{22}\) Descriptive statistics (mean, standard deviation, and proportions) were used to describe the quantitative and categorical variables. The Pearson chi-square test was used to compare the distribution of learning style preferences between the male and female students. One-way analysis of variance followed by post hoc multiple comparison Tukey test was used to compare the mean GPA values of students across their learning style preferences. The analysis was carried out using SPSS version 16 (SPSS Inc., Chicago, IL, USA). A p-value of <0.05 was considered statistically significant.

### Results

The response rate was 93 percent (105/113). The majority of the students (60.9 percent) were male (64/105). The mean age was eighteen years. The mean (SD) GPA of the students was 4.712 (0.214).

More than half of the students exhibited a multiple learning preference (59 percent); of those, 21 percent, 19 percent, and 19 percent were bi-modal, tri-modal, and quad-modal, respectively. Among students who had a single learning preference, the aural learning style was found to be the most prevalent (20 percent), followed by kinesthetic (15.2 percent). Read-write and visual learning styles were the least prevalent single mode with 2.9 percent each. Figure 1 shows the general distribution of different learning preferences among the study group. Among the students who exhibited a bi-modal learning style, AK (aural/kinesthetic) was the dominant preference combination (15.2 percent). Among students who had a tri-modal learning style, the ARK (aural, read-write, kinesthetic) combination was the most dominant (9.5 percent), followed by the VAK (visual, aural, kinesthetic) combination (5.7 percent). Overall, the most common learning preferences were aural (A); visual, aural, read/write, kinesthetic (VARK); and aural, kinesthetic (AK). The majority of the male students had a single or tri-modal learning preference, whereas more than half of the female students had a quad-modal learning preference (Figure 2).

There were no statistically significant differences between males’ and females’ learning style
preferences (p=0.088) (Figure 3). However, there was a statistically significant difference in the mean values of GPA in relation to the students’ learning style preferences (p=0.019). Further analysis by Tukey post hoc test revealed that the students with a single learning style preference had a lower mean GPA than those with multiple (quad-modal) learning style preferences (Figure 4).

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**Figure 1.** Prevalence (percentage) of dominant single and multiple learning preferences among study group (n=105)

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**Figure 2.** Gender differences among each learning style preference (within Learning Style)
ods of instruction, and consider accommodating a variety of learning preference modalities. All of this knowledge will help them to develop more effective curricular approaches.\(^{13,26}\)

In this study, multimodal learning preferences were found to be dominant (59 percent) among...
first-year dental students, which indicates that most of them preferred to learn by more than one mode of information presentation. Multimodal learning preferences are considered typical of adult learners. This finding is in agreement with other studies on undergraduate and postgraduate dental students that have used VARK as learning style inventory. The multimodal learning style was found to be the dominant learning preference as well among undergraduate medical, nursing, and midwifery students.

Among the first-year Saudi dental students participating in this study, aural preferences (20 percent) followed by kinesthetic (15.2 percent) preferences were the most prevalent single learning preferences. Similarly, Kaczmarek et al. reported that the dominant single learning preferences among Polish dental students were aural (24.3 percent) followed by kinesthetic (18 percent). The same preferences were also found to be dominant (10.5 percent for each) among postgraduate dental students. Additionally, aural (11.6 percent) and kinesthetic (8.1 percent) preferences were found to be the two dominant single learning preferences among Saudi undergraduate medical students.

By contrast, Murphy et al. reported that read-write (20.1 percent) and visual (14.5 percent) preferences were the two dominant single learning preferences among predoctoral U.S. dental students. Their study was conducted with students in the four classes of Temple University School of Dentistry.

Among the male and female students who participated in my study, there were some differences in learning style preferences; however, these differences were not statistically significant. The majority of male students preferred a single mode of learning, while more female students preferred multimodal (quad-modal) learning. Similarly, in other studies, gender differences were found to be not significant among dental, medical, and midwifery students.

In contrast, significant gender differences were found among physiology undergraduates, where the majority of male students preferred a multimodal (VARK) learning style whereas the majority of female students preferred a single-mode of learning.

Past performance is often used as a predictor of current or future performance. In this study, the GPA in the preparatory year was used as an indicator of the students’ past academic performance. The preparatory program at King Saud University adopts the annual system in which students have to complete all the requirements in one academic year (two semesters plus an exceptional summer semester) with a GPA no less than 3 out of 5. At the beginning of the year, the student must choose one track (medical, engineering and scientific, or humanities) depending on which college the student wishes to attend. The basic courses taught include Communication Skills, Biostatistics, Learning, Thinking and Research Skills, and Health and Fitness. The main method of instruction is lecture, and the students are required to submit assignments, portfolios, and group projects.

The subjects required to be studied in the preparatory year are variable, with each requiring a different learning approach. For example, abstract learning in the mathematics class may be contrasted with group activities and projects in the communication skills class. This may explain the dominant multimodal learning preferences among the students. The first year in dental school also involves multiple subjects in basic sciences and introductory dental courses, most of which are theoretical with limited practical/ psychomotor skills; the student’s approach to study is very likely to be similar or at least comparable to that in the predental year.

After successful completion of the preparatory predental program, students with the highest university GPA are admitted to the College of Dentistry based on their priority list of colleges and the availability of positions. In dental school, methods of information delivery are varied according to the level and subjects being taught, ranging from lectures to group discussions, laboratory, and clinical demonstration as well as project assignments.

In this study, a statistically significant association was found between the GPA of students in the preparatory year and their learning style preferences. A lower mean GPA (4.648) was found among students who preferred a single mode of learning, while a higher mean GPA (4.819) was found among students with multiple (quad-modal) learning style preferences. On the other hand, no statistically significant differences were found in the mean GPA among the other pair of learning style preferences. Among first-year medical students, Baykan and Nacar did not find any significant differences in the first-semester GPA and learning styles of the students.

Dental students are adult learners who come into professional school with different styles of learning acquired through many years of study. The first year in dental school can be overwhelming for many students due to the large amount of information and multiple subjects taught in both dental and basic science courses. A better understanding of learning styles by the faculty can help reduce the students’ level of frustration and improve instructional delivery.
methods. Furthermore, when students' awareness level of their preferred learning modality is raised, it can improve students' learning outcomes and help them to actively cope with the academic demands of dental school.

According to Marcy, a simple intervention such as administering a learning style inventory early in the students’ didactic phase of education can lead to improved learning. It has been suggested that the faculty members who are consciously aware of their students’ learning styles as well as their own are in a position to make more informed choices in course materials, design, and learning processes that broaden the opportunities for effective learning in their courses. It is helpful also for educators to know their teaching styles in order to examine and improve their teaching methodologies. This knowledge provides a guide to create more positive and effective learning environments for all students. It has been recommended that educators should use cooperative active teaching/learning methods as a vehicle to achieve the goal of training dentists to be critical thinkers, problem-solvers, lifelong learners, and skillful in peer- and self-evaluation and to help them acquire skills that support professional development.

In this study, the students were informed that the learning preference results provided were a method for self-knowledge and were not intended to limit or label them to a certain mode of learning. VARK results can provide a vehicle for self-knowledge and help to explore opportunities for making the dental educational experience both more productive and enjoyable for students and faculty members. According to Fleming and Baume, knowing one’s learning style can be beneficial if learners take the next step and consider how and when they learn as part of a reflective, metacognitive process, with action to follow. It is the beginning of a dialogue, not a measure of personality. However, Stellwagen warned against misapplication of learning style inventories that may lead to stereotyping and prejudicial labeling of individuals. It may obscure the understanding that learning style evolves over one’s life and one’s academic/professional career. Learning preferences, like other individual characteristics, should be viewed as a continuum.

Do students learn best if they use their preferred mode of learning? Some researchers have suggested that the student’s strongly preferred mode may not always be the best way to learn, depending on particular circumstances. Students may need to adapt to learning modalities differing from their preferences because of real-life environmental constraints. Some dental students may undergo a shift in learning preferences as the learning environment changes from lecture hall to preclinical laboratory to patient clinic. The most effective learners are able to adapt to the style that the learning situation requires. Teachers can help them develop strategies for adapting to differing situations, especially when learning styles do not fit the task. Grasha suggests that some faculty members introduce different modes of instructional delivery to acknowledge the diversity of the learners that they teach. If teachers use a variety of teaching methods and styles, then learners are exposed to familiar and unfamiliar ways of learning that provide comfort and tension during the process, ultimately giving the learners multiple ways to excel.

Limitations of the current study must be acknowledged. These begin with the type of sample used, which is a convenience sample of students with different gender distribution from a single academic institution. Therefore, the sample might not represent the population of dental students across Saudi Arabia. Another possible limitation is the self-report of GPA by the students. In future studies, larger sample sizes from multiple institutions are recommended. In addition, longitudinal studies are needed to track and compare learning preferences among dental students throughout their years in dental school.

**Conclusion**

More than half (59 percent) of the first-year Saudi dental students who participated in this study were found to have multimodal learning preferences. The most common single learning preference was Aural (A) followed by Kinesthetic (K). The majority of male students had single or tri-modal learning preferences, whereas more than half of the female students had a quad-modal learning preference. A lower mean GPA (4.648) was found among students who preferred a single mode of learning, while a higher mean GPA (4.819) was found among students with a multiple (quad-modal) learning style preference. The results of this study can provide useful information for improving the quality of the teaching and learning experiences of dental students in their early years in the dental college. For effective instruction, dental educators need to broaden their range of presentation styles to help create more positive and effective learning environments for all students.
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