Assessing Learning Styles of Saudi Dental Students Using Kolb’s Learning Style Inventory

Dalal A. AlQahtani, B.D.S., M.Sc.; Sara M. Al-Gahtani, B.D.S.

Abstract: Experiential learning theory (ELT), a theory developed by David Kolb that considers experience to be very important for learning, classifies learners into four categories: Divergers, Assimilators, Convergers, and Accommodators. Kolb used his Learning Style Inventory (LSI) to validate ELT. Knowing the learning styles of students facilitates their understanding of themselves and thereby increases teaching efficiency. Few studies have been conducted that investigate learning preferences of students in the field of dentistry. This study was designed to distinguish learning styles among Saudi dental students and interns utilizing Kolb’s LSI. The survey had a response rate of 62 percent (424 of 685 dental students), but surveys with incomplete answers or errors were excluded, resulting in 291 usable surveys (42 percent of the student population). The independent variables of this study were gender, clinical experience level, academic achievement as measured by grade point average (GPA), and specialty interest. The Diverging learning style was the dominant style among those in the sample. While the students preferred the Assimilating style during their early preclinical years, they preferred the Diverging style during their later clinical years. No associations were found between students’ learning style and their gender, GPA, or specialty interest. Further research is needed to support these findings and demonstrate the impact of learning styles on dental students’ learning.

Dr. AlQahtani is Lecturer and Medical Education Specialist, Department of Oral Medicine and Diagnostic Sciences, College of Dentistry, King Saud University, Riyadh, Saudi Arabia; and Dr. Al-Gahtani is Demonstrator, Department of Oral Medicine and Diagnostic Sciences, College of Dentistry, King Saud University, Riyadh, Saudi Arabia. Direct correspondence and requests for reprints to Dr. Dalal ALQahtani, Department of Oral Medicine and Diagnostic Sciences, College of Dentistry, King Saud University, P.O. Box 60169, Riyadh 11545, Saudi Arabia; dalalq@ksu.edu.sa.

Keywords: learning styles, Kolb learning style inventory, dental students, dental education, Saudi Arabia

Submitted for publication 7/23/13; accepted 10/26/13

Students learn in a variety of ways, preferentially incorporating and processing different types of information in different ways. Successful medical teaching requires teachers to address the variations in learning styles and approaches in order to understand learners’ needs. Experiential learning theory (ELT) is one of the best-known learning theories. In 1984, David Kolb proposed ELT, which focuses on experience as the chief contributor to the learning process. The emphasis on the central role of experience differentiates ELT from other learning theories.

Kolb’s theory defines two continuums necessary for learning to occur: the perceiving continuum (grasping) and the processing continuum (transformation). These two continuums can be conceptualized as axes forming four quadrants (Figure 1). On the vertical axis, the learner perceives experience either through a new event (concrete experience) or the attempt to conceptualize an idea or theory (abstract conceptualization). On the horizontal axis, the learner can make an experience new and meaningful either by reflecting on it (reflective observation) or applying it (active experimentation). The combination of the two axes (continuums) creates four quadrants representing four learning styles: 1) Diverging—the learner perceives information through concrete experience and processes it through reflection (feeling and watching); 2) Assimilating—the learner perceives information through abstract conceptualization and processes it through reflection (thinking and watching); 3) Converging—the learner perceives information through abstract conceptualization and processes it through action (thinking and doing); and 4) Accommodating—the learner perceives information through concrete experience and processes it through action (feeling and doing). According to Kolb’s model, in an ideal learning process, the learner would cycle through all the learning quadrants in response to situational demands. However, influenced by personality type, culture, and the task at hand, the learner comes to prefer one or two learning styles.

Based on the ELT model, Kolb developed the Learning Style Inventory (LSI), a self-assessment tool used to determine an individual’s preferred learning style. This tool was developed mainly to increase the individual’s understanding of his or her preferred
Our literature search showed that very few studies have been published on the learning styles of dental students, and no dental-related study investigating learning styles based on Kolb’s ELT was found. Therefore, the purpose of our study was to identify the dominant learning style among dental students in a Saudi dental school using Kolb’s LSI and to examine its association with gender, academic achievement, clinical experience level, and specialty interest.

Materials and Methods

Ethical approval for the study was granted by the College of Dentistry Research Centre (CDRC) of King Saud University in Riyadh, Saudi Arabia. The participants were undergraduate dental students in the College of Dentistry at King Saud University. The six-year undergraduate program consists of a five-year basic dental education program and a mandatory year-long internship. The first two years are devoted to studying biomedical and preclinical dental sciences. Full exposure to clinical sciences and patient management begins in the third year and lasts
until graduation. During the internship in the sixth year, the interns are allowed to manage patients under reduced supervision.

This study employed a cross-sectional design. The independent variables were gender, level of clinical experience (preclinical versus clinical years), academic achievement as measured by grade point average (GPA), and specialty (only for fifth-year students and interns). The dental specialties were preventive dentistry, operative dentistry, biomaterials, informatics, oral diagnosis, surgery, prosthodontics, periodontics, pedodontics, endodontics, and orthodontics. Participants’ learning style was the dependent variable.

Kolb’s LSI (version 3.1) was used to assess individual learning styles. The twelve-point questionnaire had four choices for each prompt, which the examinees ranked by similarity to their learning style. The questionnaire included a cover page detailing aspects of the study; the consent form; a page gathering personal information, including gender, clinical experience level, GPA, and intended field of specialization selected from a list of dental specialties; and finally, Kolb’s LSI (version 3.1). The LSI 3.1 total normative group has been shown to be both a reliable and a valid instrument. Reliability has been proven, with Cronbach’s alpha coefficients ranging from 0.77 to 0.84.

The LSI questionnaire was administered to all enrolled undergraduate dental students (685 students and interns) at King Saud University. The questionnaire was presented verbally during first- to fifth-year students’ regularly scheduled classes and during interns’ on-campus discussion sessions. All participants signed an informed consent before answering the questionnaire.

Descriptive statistics including frequency, mean, and standard deviation were calculated. Statistical analysis of the data was carried out using chi-square analysis and Statistical Package for the Social Sciences (SPSS, version 21) to cross-tabulate learning styles against gender, clinical experience level, and GPA and to identify any significant associations between the groups. Statistical significance was set at p<0.05.

### Results

The survey had a response rate of 62 percent (424 of 685 dental students and interns). One hundred and thirty-five questionnaires that had incomplete answers or were filled out incorrectly were excluded, resulting in 291 usable surveys (42 percent of the student population). Personal data are shown in Table 1.

Results revealed that the most common learning style among the participants was Diverging (33 percent), followed by Accommodating (24.7 percent) and Assimilating (22.7 percent) (Figure 2). The least common learning style was Converging (19.6 percent). There was no association between gender and learning styles ($X^2=6.071$, p=0.108) (Figure 3).

Male participants revealed a higher though not significant preference for the Diverging style compared with their female counterparts (37.5 percent vs. 26.8 percent).

To determine the relationship between clinical experience and learning styles, the sample was divided into two groups. First- and second-year students were called the preclinical group, and the third-, fourth-, and fifth-year students and interns were called the clinical group. The data showed a highly significant relationship between learning styles and clinical experience ($X^2=16.679$, p=0.001). The students exhibited a preference for the Assimilating style in their early preclinical years (32.1

<table>
<thead>
<tr>
<th>Table 1. Demographic profile of participants in study (n=291)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Academic achievement (GPA)</strong></td>
</tr>
<tr>
<td>High achievers (4.5-5)</td>
</tr>
<tr>
<td>Low achievers (below 4.5)</td>
</tr>
<tr>
<td>Missing data</td>
</tr>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td>First</td>
</tr>
<tr>
<td>Second</td>
</tr>
<tr>
<td>Third</td>
</tr>
<tr>
<td>Fourth</td>
</tr>
<tr>
<td>Fifth</td>
</tr>
<tr>
<td>Interns</td>
</tr>
<tr>
<td><strong>Clinical level</strong></td>
</tr>
<tr>
<td>Preclinical</td>
</tr>
<tr>
<td>Clinical</td>
</tr>
<tr>
<td><strong>Specialty interest (fifth-year students and interns)</strong></td>
</tr>
<tr>
<td>Oral diagnosis and surgery</td>
</tr>
<tr>
<td>Other dental specialties</td>
</tr>
<tr>
<td>Both</td>
</tr>
</tbody>
</table>
percent) but the Diverging style in the later clinical years (40.9 percent).

For the purposes of this study, GPA was used to divide the participants into two groups: high achievers with a GPA from 4.5 to 5 and low achievers with a GPA below 4.5. The findings indicated that the participants’ GPA was not associated with learning style ($X^2=5.492$, $p=0.139$).

In this study, specialties were clustered according to the characteristics of their respective clinical practice: a) oral sciences (oral diagnostic sciences and oral surgery); b) other dental specialties (preventive dentistry, operative dentistry, biomaterials, informatics, prosthodontics, periodontics, pedodontics, endodontics, and orthodontics); or c) both a and b. There was no significant association between learning styles and the senior students’ specialty choices ($X^2=6.658$, $p=0.673$).

**Discussion**

This study was intended to identify the dominant style of a group of undergraduate dental students and interns in Saudi Arabia and to explore the associations of learning style with certain demographic variables. The dominant learning style in the sample was Diverging (33 percent). Diversers approach knowledge through concrete experiences (feeling) and transform it using reflective observation (watching). They tend to view situations from different points of view. They also enjoy exercising their imagination and generating ideas, possess a high degree of interest in culture, and accumulate information to supplement their existing skill set. In the environment of institutionalized education, they tend to be open-minded and prefer a dynamic exchange of ideas. Finally, they take pleasure in constructive intellectual activities, such as brainstorming and actively publishing in blogs and journals.

Accommodators accounted for 24.7 percent of the sample. Those who favor this learning style exhibit a preference for concrete experience and active experimentation. These learners enjoy working in groups and on projects in more challenging settings. They also prefer hands-on experiences and relying on people for collecting information to solve problems.

It is a positive finding that 57.7 percent of participants in this study (dental students) were categorized as Diversers or Accommodators. These concrete learners like to acquire knowledge through concrete experiences in accordance with Kolb’s learning cycle. Concrete learners are sensitive to others’ feelings, which is especially important for dealing with patients and medical staff. It has also
been suggested that concrete learners prefer people-oriented professions.\textsuperscript{9,10} On the other hand, Assimilators comprised 22.7 percent of the participants. These students prefer to learn through reflective observation and abstract conceptualization.\textsuperscript{2} In addition, Assimilators are more interested in ideas, although they do not care much about their practical application.\textsuperscript{9} Nevertheless, Assimilators possess high proficiency in systematic planning and logic. They favor lectures, reading, and conceptualizing theoretical models.

Converging learners accounted for 19.9 percent of the participants. These students are believed to learn concepts through a combination of abstract conceptualization and active experimentation.\textsuperscript{2,9} They display a high level of problem-solving skills and are interested in actual implementation of theories. They like laboratory sessions and experiments.\textsuperscript{5}

It is interesting to compare these dental students’ learning styles with those of other health professions. One study showed that medical students’ predominant learning style was Assimilating, followed by Converging;\textsuperscript{11} another study found the predominant learning style of first-year pharmacy students was Accommodating, followed by Converging.\textsuperscript{12} Nursing students, who tend to be more people-oriented, have been found to most commonly prefer a Diverging learning style.\textsuperscript{10,13}

In our study, there was no association between gender and learning style. This finding differs from

Figure 3. Distribution of participants’ learning styles according to gender, level of clinical experience, academic achievement, and specialty interest
that of Adesunloye et al., who established that Kolb’s LSI is sensitive to gender. Kolb LSI 3.1, in particular, exhibits a small yet consistent gender-related difference: men have been found to prefer abstract conceptualization (thinking things through) more so than their female colleagues. Nevertheless, using earlier versions of LSI, two studies found no gender-related differences in learning style.

Our study revealed significant differences between the learning styles of students in their earlier years of study and those in the later years. These findings suggest that preclinical first- and second-year students tend to exhibit Assimilating learning style. This finding may be due to the theoretical lectures and practical sessions that take up a large portion of the preclinical years. However, during the clinical years, students gather knowledge and experience in clinical settings and apply it in patient management and communication with dental personnel. These students begin to develop a Diverging learning style. Similar to the findings of our study, Engels and de Gari found a significant difference in learning styles by level of training, with second-year preclinical undergraduate medical students preferring the Assimilating style and general surgery residents the Converging style.

While our cross-sectional study identified differences in the learning styles of students at different stages of education at a given point in time, other studies have suggested that these differences may occur over time. A recent study by Bitran et al. demonstrated that medical students’ learning style changed during their undergraduate years from Assimilating (thinking and watching) to Converging (thinking and doing). This observation coincides with Kolb’s theory that an individual’s learning style may change over time.

In our study, we did not find a relationship between learning styles and academic achievement, possibly because GPA was the single indicator of academic performance. However, previous studies have examined the relationship between learning styles and other academic performance measures such as high-stakes examination scores. Lynch et al. found a significant relationship between learning style and performance on the United States Medical Licensing Examination Step 1. These results indicated that abstract learners (Convergers and Assimilators) scored significantly higher on the multiple-choice questions than concrete learners. However, there was no relationship between learning style and clinical performance measured using computer-based case simulations. These findings demonstrate that learning style has an impact on objective measures of academic achievement, while application of that knowledge in clinical settings might require other abilities beyond those measured. Two other studies also found a significant relationship between high grades and the Converging learning style.

Regarding the effect of learning style on career selection, Kolb assumed that individuals’ learning styles predispose them to select a professional area that matches their style. Convergers, according to Kolb, prefer professional fields such as medicine, economics, and computer sciences, while Accommodators prefer educational sciences, communication, and nursing. Also, he posited that Divergers prefer art, history, psychology, and literature and Assimilators the natural sciences, law, and social sciences. In our study, we did not find a relationship between Kolb’s learning styles and choice of specialty, perhaps due to the small sample size in each category.

The ELT has received some criticism for decontextualizing the learning process and emphasizing individual experience while neglecting many factors that could influence learning (e.g., social status, gender, culture). Nevertheless, the ELT has contributed to educational theories by illuminating the role of experience in learning.

In assessing the impact of this study, two limitations deriving from the study setting should be considered. First, the study was conducted at one dental college and might not be representative of all dental students across Saudi Arabia. However, the College of Dentistry of King Saud University in Riyadh, which began operating in 1975, is one of the largest dental schools in Saudi Arabia and the College of Dentistry of King Saud University in Riyadh, which began operating in 1975, is one of the largest dental schools in Saudi Arabia and the first university-based dental training institution in the Arabian Gulf. Second, the findings should be seen in the context of Saudi dental students. Dental education can vary greatly in different areas of the world based on admission criteria, curriculum type and content, school environment, and culture. These factors could affect the generalization of the results to dental students in other countries.

To advance constructive recommendations, additional studies could compare the learning styles of students in different specialties (e.g., dentistry, nursing, medicine, pharmacy). University administrators could employ these recommendations to organize curricula more effectively and maximize benefits for students. The change in students’ learning styles over time could be confirmed by longitudinal studies focused on a cohort of students as they pass through
the preclinical and clinical years and by studies comparing the learning styles of dental students and specialized residents and consultants.

**Conclusion**

This study found that the Diverging learning style was dominant among these Saudi dental students. Our study also revealed an interesting relationship between dental students’ learning style and level of clinical experience. Assimilators were more numerous during the preclinical years and Divergers in the clinical years. No statistically significant relationships were found between learning style and gender, academic achievement, and specialty interest.

**Acknowledgments**

We would like to thank the College of Dentistry Research Center and Deanship of Scientific Research at King Saud University, Saudi Arabia, for funding this research project (Research project #FR0005). Our gratitude is also extended to all who helped us in the distribution of the questionnaire among students. Dr. Ibrahim O. Bello is acknowledged for reading through the manuscript, and Mr. Nasser Al-Maflehi for his help in the statistical analysis.

**REFERENCES**