Predicting Academic Performance of Dental Students Using Perception of Educational Environment

Asim A. Al-Ansari, DScD; Maha M.A. El Tantawi, PhD

Abstract: Greater emphasis on student-centered education means that students’ perception of their educational environment is important. The ultimate proof of this importance is its effect on academic performance. The aim of this study was to assess the predictability of dental students’ grades as indicator of academic performance through their perceptions of the educational environment. The Dundee Ready Educational Environment Measure (DREEM) questionnaire was used to assess dental students’ perceptions of their educational environment at the University of Dammam, Saudi Arabia, in academic year 2012-13. Aggregate grades in courses were collected at the end of the semester and related to levels of perception of the five DREEM domains using regression analysis. The response rate was 87.1% among all students in Years 2-6. As the number of students perceiving excellence in learning increased, the number of students with A grades increased. Perception of an environment with problems in the atmosphere and social life increased the number of students with D and F grades. There was no relation between any of the DREEM domains and past academic performance as measured by GPA. This study concludes that these students’ academic performance was affected by various aspects of perceiving the educational environment. Improved perception of learning increased the number of high achievers, whereas increased perception of problems in atmosphere and social life increased the number of low achievers and failing students.

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With the worldwide movement towards ensuring quality in education, greater focus is attached to seeking feedback and assessing stakeholders’ satisfaction. Students are among the main stakeholders in the dental education process since they are the direct beneficiaries of this process and fund it either directly or indirectly.1 Dental educators are responsible for ensuring a positive academic experience for dental students.2 The Dundee Ready Educational Environment Measure (DREEM) is a tool that has been validated and tested for use in health professions education institutions3 and has recently been cited as one of the most suitable instruments for assessing students’ perception of the educational environment in these institutions.4 Students’ perception of educational environment has been found to be related to past academic achievement assessed by self-reported cumulative grade point average (CGPA).5 Medical students with previous satisfactory academic achievement were found to have significantly better perceptions of teachers, academic self-perception, and atmosphere than students who were underachieving.6 Few studies have assessed the relation between academic performance and perception of educational environment among dental students. One such study found no correlation between DREEM total or domain scores and students’ performance in the first state examination among German dental students who have already passed this exam.7 Most of the studies, however, attempted to relate perception of educational environment to performance on exams already conducted at the time of assessment, thus focusing on association. If such an association was proved in these studies, it may be concluded that good students tend to think well of their schools. A matter of additional interest is to assess whether positive perception of educational environment can predict performance...
in future exams. Such a relation would further stress the importance of students’ perception of educational environment and enable decision makers to appropriately incorporate aspects of educational environment perception into action plans for courses improvement. The aim of this study was to assess the relation between dental students’ perception of educational environment as measured by the DREEM and their subsequent academic performance reflected in course grades and to assess whether those grades can be predicted by their perceptions in various domains. The study was conducted in the College of Dentistry, University of Dammam, Kingdom of Saudi Arabia, in December 2012.

**Materials and Methods**

Approval to conduct the study was obtained from the Research Unit, College of Dentistry, University of Dammam. To be admitted to the College of Dentistry, new high school graduates must enroll in a one-year preparatory program to prepare them for the medical track (Schools of Medicine, Dentistry, Pharmacy, or Applied Medical Studies). Students must achieve a specific GPA in the preparatory program in addition to passing a manual dexterity test, conducted by the College of Dentistry, to be accepted into the five-year Bachelor of Dental Surgery (BDS) program. The average ages at entry and graduation from the BDS program are 19 and 24 years, respectively.

This study included students enrolled in Years 2-6 of the program (the five years of the BDS curriculum). Students enrolled in Year 1 (the preparatory year) were not included because they attended basic science classes offered by the Deanship of Preparatory Year and Support Studies. The numbers of students enrolled in the second, third, fourth, fifth, and sixth years were 70, 42, 28, 20, and 26, respectively. The 70 students in the first year consisted of 38 males and 32 females; there were no female students in the third to sixth years because the college began accepting female students in fall 2011.

Students were invited to respond to the self-administered DREEM. A cover letter that accompanied the anonymous questionnaire explained the purpose of the study and affirmed that participation was voluntary with no penalty incurred in case of no participation. The questionnaires were distributed and collected in the same session. The questionnaire consisted of 50 questions assessing students’ perceptions in five domains: perception of learning (12 questions), academic self-perception (8 questions), perception of atmosphere (12 questions), and social self-perception (7 questions) (Table 1). The original English version of the questionnaire was used. Students responded using a Likert scale ranging from strongly disagree (0) to strongly agree (4). In negative statements (items #4, 8, 9, 17, 25, 35, 39, 48, and 50), the direction of the scale was reversed.?

Scores in the five domains had potential maximum values of 48, 44, 32, 48, and 28, respectively. Domain totals were calculated and transformed to percent score to allow inter-domain comparison. Based on domain scores, the educational environment perception was divided into four levels: very poor educational environment, educational environment with plenty of problems, educational environment with more positives than negatives, and excellent educational environment. Cut points were used so that the potential scale of each domain was divided equally. Students also reported their CGPA, which was used as a measure of past academic performance. At the end of the semester, students’ grades in all courses were obtained from the office of the registrar in an aggregate form since confidentiality issues prevented the release of individual students’ grades. These aggregate grades were used to assess predictability of future academic performance by DREEM domain levels.

The effect of gender, year of program, and past academic performance (CGPA) on the percent score in each of the five domains as well as differences among their percent scores was assessed using repeated measures analysis of variance with Greenhouse-Geisser correction. Parameter estimates and their confidence intervals were calculated. Pairwise comparison between estimated means was done using Bonferroni correction. The numbers of students with various levels of perception in the five DREEM domains were assessed for predicting the number with grades indicating high performance (A and A+ = As), grades indicating low performance (D and D+ = Ds), and grades indicating failure (F) using univariate analysis of variance. SPSS version 17.0 was used for statistical analysis. Significance was set at the 5% level.

**Results**

Of the 186 students in second to sixth years who received the questionnaire, 162 returned it complete (response rate=87.1%). Females repre-
presented 15.4% of all respondents. The percentages of students who completed the questionnaire in the second, third, fourth, fifth, and sixth years were 33.3%, 24.1%, 16.0%, 11.1%, and 15.4%, respectively (Table 2). For items in the subscales of perception of learning, academic self-perception, and perception of atmosphere, internal consistency was satisfactory (Cronbach alpha=0.71, 0.73, and 0.76, respectively), whereas the consistency of items assessing students’ perception of teachers and their social self-perception was lower (Cronbach alpha=0.50 and 0.34, respectively).

Table 1. Five domains of items on the DREEM questionnaire

Students’ perceptions of learning
1. I am encouraged to participate in class.
7. The teaching is often stimulating.
13. The teaching is student-centered.
16. The teaching helps to develop my competence.
20. The teaching is well focused.
22. The teaching helps to develop my confidence.
24. The teaching time is put to good use.
25. The teaching overemphasizes factual learning.
38. I am clear about the learning objectives of the course.
44. The teaching encourages me to be an active learner.
48. The teaching is too teacher-centered.

Students’ perceptions of teachers
2. The teachers are knowledgeable.
6. The teachers are patient with patients.
8. The teachers ridicule the students.
9. The teachers are authoritarian.
18. The teachers have good communication skills with patients.
29. The teachers are good at providing feedback to students.
32. The teachers provide constructive criticism.
37. The teachers give clear examples.
39. The teachers get angry in class.
40. The teachers are well prepared for their classes.
50. The students irritate the teachers.

Students’ academic self-perceptions
5. Learning strategies that worked for me before continue to work for me now.
10. I am confident about my passing this year.
21. I feel I am being well prepared for my profession.
26. Last year’s work has been a good preparation for this year’s work.
27. I am able to memorize all I need.
31. I have learned a lot about empathy in my profession.
41. My problem-solving skills are being well developed here.
45. Much of what I have to learn seems relevant to a career in health care.

Students’ perceptions of atmosphere
11. The atmosphere is relaxed during the ward teaching.
12. This school is well time-tabled.
17. Cheating is a problem in this school.
23. The atmosphere is relaxed during lectures.
30. There are opportunities for me to develop interpersonal skills.
33. I feel comfortable in class socially.
34. The atmosphere is relaxed during seminars/tutorials.
35. I find the experience disappointing.
36. I am able to concentrate well.
42. The enjoyment outweighs the stress of the course.
43. The atmosphere motivates me as a learner.
49. I feel able to ask the questions I want.

Students’ social self-perceptions
3. There is a good support system for students who get stressed.
4. I am too tired to enjoy the course.
14. I am rarely bored on this course.
15. I have good friends in this school.
19. My social life is good.
28. I seldom feel lonely.
46. My accommodation is pleasant.


Table 2. Responding students by program levels

<table>
<thead>
<tr>
<th></th>
<th>Respondents</th>
<th>Total Number in Program Level</th>
<th>Response Rate</th>
<th>Percentage of Total Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second year: males</td>
<td>29</td>
<td>38</td>
<td>76.3%</td>
<td>17.9%</td>
</tr>
<tr>
<td>Second year: females</td>
<td>25</td>
<td>32</td>
<td>78.1%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Third year</td>
<td>39</td>
<td>42</td>
<td>92.9%</td>
<td>24.1%</td>
</tr>
<tr>
<td>Fourth year</td>
<td>26</td>
<td>28</td>
<td>92.9%</td>
<td>16.0%</td>
</tr>
<tr>
<td>Fifth year</td>
<td>18</td>
<td>20</td>
<td>90.0%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Sixth year</td>
<td>25</td>
<td>26</td>
<td>96.2%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Total</td>
<td>162</td>
<td>186</td>
<td>87.1%</td>
<td>–</td>
</tr>
</tbody>
</table>

Note: Students in third to sixth years were all male; the college began accepting female students in fall 2011.
Figure 1 shows the mean item scores in the five DREEM domains. In the learning perception domain, items \#13 and 44 had particularly low mean scores (1.13 and 1.20). In the perception of teacher domain, items \#29, 32, and 18 had the lowest mean scores (1.25, 1.27, and 1.28). In the academic self-perception domain, the lowest mean scores were for items \#27 and 41 (1.15 and 41). The lowest scoring items in the perception of atmosphere domain were \#42 and 43 (0.98 and 1.15). In the perception of social life domain, \#14 and 28 had the lowest mean scores (1.08 and 1.23).

The relationship between year, gender, and CGPA and percent scores in the five DREEM domains is shown in Table 3. Percent scores of academic self-perception and perception of atmosphere were significantly higher than the percent scores for perception of learning, perception of teachers, and social self-perception, which did not differ significantly.

There were no differences between males and females in any of the five domains. Similarly, there was no relation between CGPA and percent scores in the five DREEM domains (F=1.10 and 0.05, p=0.30 and 0.83, respectively). Academic self-perception did not differ by year of the program. However, second-year students had better perceptions of learning, teachers, and social self-perception compared to sixth-year students (B=13.05, 11.15, and 15.87, respectively). Fifth-year students also had better perceptions of learning, atmosphere, and social self-perception than sixth-year students (B=13.05, 11.16, and 11.91, respectively).

Table 4 shows the significant relations between levels of perception in the DREEM domains and grades. The only perception affecting the number of students with As was excellence of learning (explaining 70% of the variation in their number; adjusted \(R^2=0.70\)). The number of students with Ds increased...
significantly as the number of students perceiving problems in academic self-perception increased ($R^2=0.65$). Perceived problems in atmosphere and in social life increased the number of underachieving students (D grades) and failing students (F grades). These perceptions explained greater variation in the number of failing students ($R^2=0.81$ and 0.72) than in the number of underachieving students ($R^2=0.60$ and 0.58).

**Discussion**

To our knowledge, this was the first study to assess the predictability of future academic performance using perception of various aspects of educational environment among dental students. The strengths of the study are related to providing the needed time precedence by measuring perception of educational environment and then relating this to grades on exams that took place after students expressed their perceptions. This offers a stronger criterion for causality that will need to be consistently proved by further studies. The main limitation of the study, however, is that the grades were aggregated, so that a particular perception cannot be directly traced to a student with a specific grade. Because of this, it was not possible to control for the effect of potential confounders. However, the $R^2$ of the regression model indicates that a great proportion of the variation in grades can be explained by students' perceptions of educational environment. This strong association is evidence of a causal relation between perception and future academic performance.

This study used the DREEM questionnaire to collect data from students in the College of Dentistry, University of Dammam with regards to their perception of educational environment. DREEM was previously translated into Arabic and used in other studies. In our study, however, it was used in its original English version since instruction at the college is conducted entirely in English, and it was judged that using the Arabic version would not be necessary. Similarly, the English version of the questionnaire was used among third-year students in community medicine at Dhaka Medical College in Bangladesh where instruction is conducted in English although the students were not native English speakers. In our study, internal consistency was acceptable in three domains, whereas in the social self-perception domain it was markedly low. Other studies also reported low consistency in the same

Table 3. Relationship between program level, gender, and CGPA and five DREEM domains of educational environment perception, by mean and confidence interval (CI)

<table>
<thead>
<tr>
<th></th>
<th>Perception of Learning</th>
<th>Perception of Teachers</th>
<th>Academic Self-Perception</th>
<th>Perception of Atmosphere</th>
<th>Social Self-Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>52.40 (47.80, 56.99)</td>
<td>51.49 (47.61, 55.38)</td>
<td>59.89 (53.98, 65.80)</td>
<td>57.82 (52.70, 62.95)</td>
<td>51.16 (46.46, 55.86)</td>
</tr>
<tr>
<td></td>
<td>Year 2 vs. 6</td>
<td>13.05 (4.73, 21.38)*</td>
<td>11.15 (4.12, 18.18)*</td>
<td>4.82 (-5.48, 15.52)</td>
<td>8.46 (-0.83, 17.74)</td>
</tr>
<tr>
<td></td>
<td>Year 3 vs. 6</td>
<td>6.93 (-0.18, 14.04)</td>
<td>2.48 (-3.53, 8.48)</td>
<td>-5.34 (-14.40, 3.40)</td>
<td>-2.45 (-10.38, 5.47)</td>
</tr>
<tr>
<td></td>
<td>Year 4 vs. 6</td>
<td>5.72 (-1.18, 12.32)</td>
<td>6.07 (-0.18, 12.32)</td>
<td>-1.83 (-11.34, 7.68)</td>
<td>5.79 (2.42, 14.04)</td>
</tr>
<tr>
<td></td>
<td>Year 5 vs. 6</td>
<td>13.05 (5.04, 21.07)*</td>
<td>5.88 (-0.89, 12.65)</td>
<td>-2.45 (2.34, 18.27)</td>
<td>11.16 (2.42, 19.04)*</td>
</tr>
<tr>
<td></td>
<td>Males vs. females</td>
<td>6.40 (-4.30, 15.92)</td>
<td>4.70 (3.29, 12.69)</td>
<td>4.86 (-2.31, 17.02)</td>
<td>-2.02 (-12.57, 8.53)</td>
</tr>
<tr>
<td></td>
<td>CGPA</td>
<td>-1.32 (-5.94, 3.31)</td>
<td>0.50 (3.41, 4.41)</td>
<td>-0.05 (-5.99, 5.89)</td>
<td>-0.35 (-4.81, 4.51)</td>
</tr>
</tbody>
</table>

Note: Letters a and b denote significant differences by Year (F=5.08, p=0.001), Gender ($F=1.10, p=0.30$), and CGPA ($F=0.05, p=0.83$).
domain with their authors’ attributing this to possible construct validity issue of the original DREEM\textsuperscript{12} or the few items the domain contained.\textsuperscript{7}

The main problems identified in our study were similarly identified in previous studies. Other studies\textsuperscript{7,11,12} reported learning domain problems, in which the experience revolves around the teacher and the student is expected to be a passive recipient of information in spite of the increasing emphasis on student-centered educational techniques to enhance active learning.\textsuperscript{12} This may explain why the lowest scoring items in academic self-perception were related to inability to memorize and perceived inability to solve problems. The concern for overemphasis on memorization was also raised by North American dental students in a cross-sectional survey of perceived strengths and weaknesses of dental school curricula.\textsuperscript{13} Teachers’ perception problems with the lowest scores were related to inadequate feedback about performance, which dental students regard as a desirable attribute of teachers.\textsuperscript{14}

The lowest scoring item in perception of atmosphere was related to stress. A 2014 systematic review concluded that dental students face many stresses because of the nature of their training.\textsuperscript{15} Problems in social self-perception related to boredom were reported in other studies,\textsuperscript{12,16} again because of the demanding nature of medical and dental academic life.\textsuperscript{12} Similar to other studies,\textsuperscript{7,9,17} students in our study also had a problem with the inadequate support system that can help them deal with stresses and boredom. On the other hand, it was reported that partly because of the presence of an organized structure to offer academic and pastoral support, students at Peninsula Dental School in the UK had no stress problem.\textsuperscript{18}

In our study, students in the second year had significantly higher scores than students in the sixth year in the domains of perception of learning, teachers, and social life. Similarly, higher perception scores were reported by Kossioni et al. for junior compared to senior students although significant differences existed only in the domain of learning perception.\textsuperscript{12}

CGPA as a measure of past academic performance was not significantly related to any of the five DREEM domains. This means that whether students scored high or low, they still perceived their learning to be non-interactive and centered on the teacher—a situation in which they are expected to memorize facts rather than solve problems, and they get stressed and miss a student support system. The lack of association can partly be attributed to the fact that the perception of educational environment measured at the time of the study may have completely differed from that at the time of the exams whose CGPA was reported by students. In environments in which extensive modifications are being made, perception of environment is expected to change accordingly and cannot be therefore used as a constant construct by relating it to CGPA accumulated over more than one semester. Edgren et al. used the DREEM to compare perceptions at two time points for a curriculum undergoing reform.\textsuperscript{19} This indicates the need to consider the effect of curricular changes on DREEM scores and their stability.

Our study shows, however, that the way students perceive their environment is related to how they do in future exams and that this perception can be used to predict the number of high or low achievers in an institution. It is interesting that positive perception of learning is related to good academic performance,
whereas poor performance and failure are affected by perception of atmosphere and social life. Good learning opportunities act as motivators, and while the perception of their presence increases the chances students do well, their absence does not necessarily lead to inadequate performance or failure. Learning/teaching best practices promote excellence. On the other hand, a good support system, relaxed environment, and feeling of belonging do not guarantee that students excel; but they act as a safety net that keeps stressors at a safe academic level. It is important that academic institutions identify students’ needs and plan solutions. If the problem is related to high failure rates or poor performance, then a good support system offering counseling and advising is needed, so students can seek and find help and feel relaxed.

In institutions seeking excellence through incubating talents and nurturing high-achieving students, it would be reasonable to invest in high caliber teaching staff who can challenge the students and stretch their learning abilities. Wayne et al. evaluated the effect of students’ perception of their learning environment on their performance in the United States Medical Licensing Examination (USMLE) Step 1. Three learning environment subscales were significantly associated with performance: meaningful learning environment, emotional climate, and student-student interaction, so that one point increase in the scores of these subscales was associated with an increase in the exam score. Other studies also highlighted the importance of social environment for student performance although there was less distinction between whether it increased the chances of excelling or decreased the chances of failing. For example, Todres et al. emphasized the importance of social life on students’ performance and reported that high achievers were more likely to positively engage with peers. Woolf et al. also analyzed social networks among medical students and concluded that reported friendship was related to subsequent exam performance. In an educational setting culturally similar to that in our study, Abdulghani et al. carried out focus group discussion with high-achieving male and female Saudi medical students and concluded that managing stress was important for academic success.

It is also important to notice that, in our study, greater variation in the number of failing students compared to the number with low performance was explained by perceived problems in perception of atmosphere and social life. Problems in academic self-perception were an additional factor affecting low performance but not failing. The absence of association between number of failing students and perceiving academic problems may reflect the inability of failing students to validly assess themselves academically and diagnose their own problems rather than the lack of effect per se. Todres et al. also found that re-sitting students were less likely to be aware of what worked in terms of learning strategies and managing difficulties than high achievers.

Future studies are needed to assess the predictability of various types of exams’ scores using aspects of perceptions of the educational environment. A particularly interesting aspect to focus on is whether perception of relaxed educational environments in classrooms, laboratories, clinics, etc. and teachers’ attitudes towards students and patients can predict performance in didactic versus clinical exams.

Conclusion

The findings of this study suggest that perception of dental educational environment affects future academic performance as reflected in end of semester grades. Perceptions in different domains affected academic performance differently. Better perception of learning increased the number of high achievers who scored A or A- grades. Poor perception of atmosphere and social life increased the number of poor achievers (students with D or D- grades) and failing students (students with F grades). Educational institutions should use appropriate measures to address various problems related to academic performance.

Acknowledgments

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REFERENCES


