Variables Predicting Students’ First Semester Achievement in a Graduate-Entry Dental School in Korea

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Abstract: The purpose of this study was to explore factors that influence academic achievement for dental students during their first semester of graduate-entry programs. Nine variables were considered, including students’ age, gender, undergraduate grade point averages (UGPAs), Dental Education Eligibility Test (DEET) scores, oral exam, and interview selection scores. DEET is a standardized aptitude test developed for graduate-entry dental programs in Korea. The test consists of four separate sections: reading comprehension, scientific reasoning parts I and II, and perceptual ability. GPA scores were obtained as a measure of academic achievement from ninety students at the graduate-entry dental program at Seoul National University, Korea. Path analysis was used to test the hypothetical model of causal influence. The most significant predictors with direct influence on achievement were scores from both scientific reasoning parts I and II, undergraduate GPAs, and gender. Age, scores from the other subjects in DEET (reading comprehension and perceptual ability), and oral exam scores were found to bear no relation to the students’ achievement.

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In recent years, one of the biggest changes to medical and dental education around the world is the introduction of graduate-entry programs, which already have been implemented for many years in the United States. Following the transition in the United Kingdom and Australia, graduate-entry medical and dental programs were introduced in Korea as a result of government initiatives.

Before 2005, all dental schools in Korea had six-year programs, where high school graduates who took the Scholastic Aptitude Test (SAT) could apply. For the first two years, students studied liberal arts and basic sciences. From their third year, students focused on dental preclinical studies, and the clinical training programs started in the fifth year. However, several negative effects of the traditional program caused dental educators to consider admitting college graduates only, rather than high school graduates, into dental school. Some of the negative effects of the traditional program were lack of awareness of social diversity and limited scientific creativity in biomedical research in dentistry.2

In 2005, four of the forty-one medical schools and five of the eleven dental schools initially changed their traditional six-year undergraduate course to a four-year graduate-entry program, where only candidates with bachelor’s degrees can apply to the dental school. The new program in Korea is different from the U.S. program in that the acquisition of the bachelor’s degree is mandatory. As of 2006, a total of twenty-seven medical schools (66 percent) and eight dental schools (73 percent) had changed or had announced that they will change their programs into graduate-entry programs.

Following this change of the educational system, a new admissions procedure was developed. To evaluate applicants’ abilities and skills developed through their prior experiences and learning, the Medical/Dental Education Eligibility Test (MEET/DEET) was developed. The subtests and contents of this standard test are similar to those of the Medical College Admission Test (MCAT) and Dental Admission Test (DAT) in the United States. For instance, DEET includes reading comprehension, scientific
reasoning parts I and II, and perceptual ability. Scientific reasoning part I evaluates students’ understanding of and problem-solving skills in biology, while part II evaluates their abilities in chemistry and physics. The perceptual ability test is only required for applicants to dental programs.5-7 In addition to scores from MEET or DEET, each school asks applicants to fulfill other requirements such as undergraduate grade point average (UGPA), interviews, oral exams, and written essays to ascertain their qualifications.

This article explores the diverse admission variables that contribute to students’ achievement in their first semester of graduate-entry dental programs. For this purpose, the hypothetical model, including students’ demographic data, admission scores (e.g., DEET, UGPA), and achievement in dental programs is applied. Compared to previous studies, this study examines the similarities or discrepancies in factors influencing students’ performances. It further discusses areas that could be improved in the admission procedures for graduate-entry programs.

Theoretical Framework for Path Analysis Model

The effects of students’ age and gender have been matters of concern in the relationship between students’ demographics and their scholastic achievements. Generally, the effect of age upon scholastic achievement in graduate-entry medical or dental programs is not clear. In several studies, younger students tend to have higher grades in the earlier years of their medical programs.5,6 In a Canadian dental school, it was also reported that younger students performed better during the second and third years as well as in clinical work.7 However, another study found that the older medical students achieved better results compared to those of younger students.8

Gender may have an influence on preadmission qualifications as well as on achievement in medical or dental programs. In the MCAT, male students were more likely to have higher scores than female students.9 In the DAT, female students produce higher scores in verbal reasoning and biological science, while the Perceptual Ability Test (PAT) displays a gender bias favoring male students.10,11 A review of the literature reveals a lack of consensus on gender differences in academic achievement in dental schools. Fields et al. showed that men significantly outsore women on the National Board Dental Examination (NBDE) I and II.12 However, the effect of gender on state board clinical exam was no longer significant when the PAT score and the quantity of clinical training were controlled. In addition, females were found to perform better overall compared to their male counterparts in graduating GPA.13

Undergraduate GPAs along with MCAT or DAT scores have been the primary means for selecting students due to their strong predictive validities.14,15 GPAs and scores from standardized aptitude tests were highly correlated with academic performance in preclinical years.16-18 However, their ability to predict students’ clinical performance is not clear. Colliver et al.19 confirmed the validity of the MCAT and the undergraduate GPA as the main predictors for performance both in clinical and basic science courses, while others suggest that they are still not useful in predicting clinical performance.7,19 Undergraduate GPAs and standardized test scores also predict students’ performance on licensing examinations, where the correlations are higher in part I (basic sciences) than in part II (clinical sciences).20

In general, interview scores have been found to possess low predictive rates for academic achievement and, in addition, to demonstrate low correlations with the other admission variables.21 However, there are some studies suggesting the interview’s significant relationship with performance in clinical training.22,23 This phenomenon implies that clinical performance validates nonacademic attributes, such as the students’ characteristics, maturity, and interpersonal skills, which are evaluated through interviews.

On the basis of previous results and the competencies that each test evaluates, the following base model is posited. As presented in Figure 1, undergraduate GPAs, DEET scores, and scores from interviews and oral exams were hypothesized to have direct causal influences on students’ achievement. Also, demographic variables such as gender and age are hypothesized to have direct influences on achievement. Among DEET scores, reading comprehension and perceptual ability scores were hypothesized to be influenced by students’ gender. In addition, reciprocal relationships were hypothesized among DEET scores, interview, or oral exam scores. Gender and age were also hypothesized to have reciprocal relationships with each other.

Methods

Data were collected from ninety (male=43, female=47) students who had completed their first
semester in a new graduate-entry dental program at Seoul National University, Korea. The students commenced their four-year dental program in the spring semester of 2005. All the students who enrolled in the program participated in the study. The students’ ages ranged from twenty-one to thirty-five years (M=24.65 years, SD=2.53) at entrance. The predominant undergraduate degree for the students was in the field of physical sciences (e.g., physics, chemistry, and engineering; 48.9 percent), followed by biological sciences (36.3 percent) and humanities and social sciences (9.1 percent). Seven of the ninety students (7.8 percent) held postgraduate degrees in addition to their undergraduate qualifications.

With full recognition of confidentiality issues, information about student admission variables was obtained from student records following approval of Seoul National University Dental Hospital’s Institutional Review Board (approval number L0605-11). Admission scores obtained for the study included DEET scores, undergraduate GPAs (UGPAs), and interview and oral exam scores. UGPA scores were adjusted into a scale of 0-100 to compare students using uniform and consistent criteria, regardless of different institutional transcript policies. The interview was semistructured and covered three domains: aptitude (interest, career knowledge, motivation), professional attitude (service experiences, ethics), and interpersonal skills (communication, personality). DEET and UGPA scores determined if the students could take the oral exam and be interviewed. The oral exam evaluated two domains: the applicants’ understanding of biological sciences (concepts, methodology) and their critical reasoning skills (logical thinking, problem solving). In both interview and oral exam, interviewers rated students using a five-point scale, and a total score of 10 was possible. All the faculty who served as interviewers participated in a one-day workshop for their training.

Students’ GPAs after their first semester were obtained as a measure of their overall academic achievement. GPA was calculated by dividing the to-
tal number of grade points earned by the total units of course weight. The curriculum of the graduate-entry program has five thematic streams that emphasize and reinforce the integration of basic sciences and clinical sciences: Human Body, Oral and Maxillofacial System, The Teeth, Clinical Dentistry, and Dentistry and Society. The courses offered in the first semester are Human Body I (cell biology and human anatomy; 8 units), Oral and Maxillofacial System I (oral structure and development and radiology; 5 units), The Teeth I (morphology, restorative techniques, and biomaterials; 6 units), Introduction to Clinical Dentistry I (1 unit), and Dentistry and Society I (1 unit). The most widely used assessment method was a written exam (multiple-choice questions or short essay) to evaluate the amount of knowledge learned in courses. The mean of GPA was 3.08 (range=1.93 to 4.19) out of the maximum 4.30, and none of the students failed in the first semester.

Prior to analyzing the results, diagnostic tests were conducted to determine multivariate normality. The skewness and kurtosis of all variables were within acceptable limits (range=-1.13 to 1.33; the absolute values are less than 2). The results from the missing data analysis proved that there were no variables with a missing rate over 5 percent. Descriptive analysis was used to describe the means and standard deviations of the selected variables. Then, correlation analyses were conducted to examine the level of association among the study variables. Finally, a path analysis was performed to test the model of variables hypothesized to determine their influences upon academic achievement after the first semester. Analysis of Moment of Structure (AMOS™ 5.0) program was used to test the hypothetical model, with SPSS 11.5 used for the descriptive analysis.

The model fit was examined with fit statistics such as $\chi^2$, Root Mean Square Error of Approximation (RMSEA), and Comparative Fit Index (CFI). Conventionally, a nonsignificant $\chi^2$ indicates that the hypothesized model fits the data well. However, because $\chi^2$ is susceptible to sample size, two supplementary fit indices that were least affected by sample size were considered: the CFI and the RMSEA. For CFI, an index of .90 or greater is considered well fitting, whereas an RMSEA of .08 to .10 indicates moderate fit and a value of less than .05 indicates a close fit of the model in relation to the degrees of freedom.  

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**Results**

**Relationships Among Students’ Variables**

Table 1 shows the results of correlation analyses among the study variables. Gender-related differences were observed in two subtests of DEET. Female students were superior in reading comprehension (r=.210, p<.05), while their scores of perceptual
ability were lower than those of the male students ($r = -.309, p < .01$).

Among the subtests of DEET, the scores from scientific reasoning part I were very highly correlated with the scores from part II ($r = .603, p < .01$). The reading comprehension scores were also correlated with the scientific reasoning part I scores ($r = .409, p < .01$). Scores of perceptual ability were positively related to scientific reasoning part II scores ($r = .208, p < .05$).

Oral exam scores were positively correlated with scores from reading comprehension ($r = .70, p < .01$) and scientific reasoning part I ($r = .88, p < .01$) and part II ($r = .222, p < .05$). Oral exam scores were also highly correlated with interview scores ($r = .622, p < .01$). UGPAs did not have any significant relationships with other admission variables.

**Path Analysis**

The base model (Figure 1) suggested a moderate fit to the data ($\chi^2 = 44.2, df = 28, p < .05$, CFI = .908, RMSEA = .081). However, the following six paths were not significant: a) the direct path from oral exam score to first-semester GPA; b) the direct path from reading comprehension to first-semester GPA; c) the direct path from perceptual ability to first-semester GPA; d) the direct path from age to first-semester GPA; e) the direct path from gender to reading comprehension; and f) the reciprocal relationship between scientific reasoning II and oral exam. These paths were removed one by one at a time, and the modified model was tested.

Figure 2 depicts the final model including significant paths. All indices indicated that the model fit the data adequately ($\chi^2 = 48.8, df = 32, p < .05$, CFI = .905, RMSEA = .077) and more parsimonious compared to the base model. That is, the CFI and RMSEA showed good fit while the chi square was still significant. Since the indices illustrate that the chosen model provided a good fit for the data, we proceeded to examine the individual parameter estimates for the model. The standardized path estimates between the observed variables and their significance levels can be seen in Figure 2.

![Figure 2. Final model for predicting achievement in the first semester](image-url)
Figure 2 shows the estimated path model for the prediction and explanation for the students’ achievements in the first semester. With respect to the relationship between gender and achievement, it can be seen that a positive path coefficient ($\beta=.245$, $p<.01$) exists. This indicates that female students performed better than male students overall in their courses during their first semesters.

The UGPA scores obtained in undergraduate studies also have a significant influence on their subsequent achievement in their first semesters. A positive coefficient exists between these two variables ($\beta=.242$, $p<.01$), which indicates that students with higher UGPA scores in their undergraduate programs succeed at a higher rate during their first semester of dental studies.

With regard to DEET, not all subtest scores directly influenced students’ achievement in their first semester. Only the scientific reasoning part I ($\beta=.317$, $p<.01$) and part II ($\beta=.229$, $p<.05$) scores are positively related to achievement. As shown in Table 1, these two science subtests have a high correlation ($r=.586$, $p<.001$). Reading comprehension and perceptual reasoning scores were not likely to predict students’ achievement in the first semester.

Figure 2 also shows that the interview score is negatively related to achievement in the first semester ($\beta=-.272$, $p<.01$), while the oral exam score does not have any significant relationship.

Discussion

The results from this study provide the first evidence of the predictive nature of admission variables in Korean graduate-entry dental programs. Hence, the results could help Korean dental school faculties to understand how students’ characteristics and admission scores can be interpreted and correlated to predict their performances. Also, the results might interest faculties in non-U.S. dental schools who are considering a change into graduate-entry programs.

Among the demographic characteristics, gender had a significant relationship with achievement in the first semester. Consistent with previous studies, female students achieved higher GPAs than male students in their first semester of the dental program. Meanwhile, students’ ages had no significant relationship with their achievement. Both results disprove concerns about the collective decline in learning aptitude in conjunction with an increase in the numbers of older and female students who enroll in dental school.

This study also confirms that undergraduate GPAs and science scores from standardized admission tests are promising predictors. However, scores from reading comprehension and perceptual ability are not significant predictors of performance. The failure of these scores to predict dental students’ performance in the first semester of school could arise from the fact that most of the courses of the first semester deal with biomedical sciences. Therefore, a longitudinal study should be instituted to examine the differential predictors for academic and clinical performance.

The results of the oral exam did not predict students’ achievement. Since the oral exam also evaluated students’ understanding of biological sciences, its nonsignificant relationship is difficult to interpret. The nonsignificance might be the result of an inadequate sample of questions or inconsistency of examiners. Meanwhile, interview scores bear a negative correlation with academic performance in the first semester, which is similar to the results from a previous study undertaken with 214 students at two Canadian schools. However, in the previous study, the interview score correlated positively with clinical achievement in the third year, thus supporting the idea that noncognitive characteristics are related to students’ clinical performance. Hence, in a future study, students’ achievement scores need to be divided into several areas (e.g., basic sciences, preclinical skills, and clinical performance) and to compare the different predictability for each area. At the same time, further efforts should be taken to improve the validity and reliability of the interview method as mentioned by other researchers.

A limitation of this study is that the study population consisted of only ninety students accepted to a single school of dentistry. Replicating this study in different dental schools in Korea would provide a basis for determining if these results can be generalized across the nation. Also, the results have to be carefully interpreted because this research assessed students’ GPA of the first semester only. The causal relationships among various admission scores and achievement would be altered if other measures at a later time are taken into account. Future research needs to refine various and different aspects of students’ achievement such as clinical performance and ethical and professional development as well as acquisition of knowledge. Also, differential contributions of admission criteria
for each performance should be computed through a longitudinal study.

REFERENCES