Critical Thinking Disposition and Skills in Dental Students: Development and Relationship to Academic Outcomes

Eli M. Whitney, DDS, Cert Oral Med, Cert Oral Path, FRCD(C); Jolanta Aleksejuniene, DDS, MSc, PhD; Joanne N. Walton, DDS, Dip Pros, FRCD(C)

Abstract: Critical thinking is a key element of complex problem-solving and professional behavior. An ideal critical thinking measurement instrument would be able to accurately predict which dental students are predisposed to and capable of thinking critically and applying such thinking skills to clinical situations. The aims of this study were to describe critical thinking disposition and skills in dental students at the beginning and end of their first year, examine cohort and gender effects, and compare their critical thinking test scores to their first-year grades. Volunteers from three student cohorts at the University of British Columbia were tested using the California Critical Thinking Disposition Inventory and California Critical Thinking Skills instruments at the beginning and end of their first year. Based on the preliminary findings, one cohort was retested at graduation when their final-year grades and clinical advisor rankings were compared to their critical thinking test scores. The results showed that students who entered dental school with higher critical thinking scores tended to complete their first year with higher critical thinking scores, achieve higher grades, and show greater disposition to think critically at the start of the program. Students who demonstrated an ability to think critically and had a disposition to do so at the start of the program were also likely to demonstrate those same attributes at the completion of their training. High critical thinking scores were associated with success in both didactic and clinical settings in dental school.

Dr. Whitney is Senior Instructor, Department of Oral Biological and Medical Sciences, Faculty of Dentistry, University of British Columbia; Dr. Aleksejuniene is Assistant Professor and Chair of Preventive and Community Dentistry, Department of Oral Health Sciences, Faculty of Dentistry, University of British Columbia; and Dr. Walton is Professor Emeritus, Department of Oral Health Sciences, Faculty of Dentistry, University of British Columbia. Direct correspondence to Dr. Eli M. Whitney, Department of Oral Biological and Medical Sciences, Faculty of Dentistry, University of British Columbia, 2199 Wesbrook Mall, Vancouver, BC V6T 1Z3, Canada; 604-822-7194; eli.whitney@dentistry.ubc.ca.

Keywords: dental education, critical thinking, dental school admissions

Submitted for publication 3/19/15; accepted 12/17/15

Dental school applicants undergo rigorous admissions processes so that institutions can select students who will develop and demonstrate not only clinical competence (knowledge, skills, and behaviors), but also professionalism, lifelong learning, and other attributes that will benefit their patients and society over a long practice career. The noncognitive (professionalism) domain includes attributes such as collaboration, communication skills, empathy, and ethical behavior and reasoning. Critical thinking is a key element of complex problem-solving that facilitates clinical practice and professional behavior. There is increased recognition of the importance of critical thinking in dental education as evidenced by its appearance as the first of six domains in the American Dental Education Association (ADEA) “Competencies for the New General Dentist.”

While there are various definitions for critical thinking and in some cases even a lack of consensus, it is defined in the ADEA competencies as “the process of assimilating and analyzing information; this encompasses an interest in finding new solutions, a curiosity with an ability to admit to a lack of understanding, a willingness to examine beliefs and assumptions and to search for evidence to support these beliefs and assumptions, and the ability to distinguish between fact and opinion.” Similarly, there are multiple definitions for critical thinking disposition and skills; however, critical thinking disposition as used in this context measures a subject’s willingness to think critically, while critical thinking skills themselves, as used in this context, are the core reasoning skills of reflective decision making.

Future dentists will need to demonstrate critical thinking in a multitude of settings. They will be
required to evaluate scientific literature, consumer-directed information, and marketing materials alike to identify biases and assess claims. Their patients will need professional guidance in interpreting the validity and reliability of information and potential treatment options, especially as it applies to their disease process/illness experience, their personal conditions, and their wants and needs. Ideally, the ability to think critically should be fostered during dental education in an environment that supports its development rather than favoring rote recall.

The health professions education literature provides examples of attempts to predict future performance by measuring critical thinking. In examining a traditional medical school preclinical curriculum, Scott and Markert administered the Watson-Glaser Critical Thinking Appraisal to a medical class during orientation and found that it was only moderately predictive of preclinical academic success. Williams et al. studied the validity of critical thinking skills and disposition as a predictor of dental hygiene student performance and found that the California Critical Thinking Skills Test (CCTST) was a good predictor of initial outcomes and acquired knowledge, but the California Critical Thinking Disposition Inventory (CCTDI) was not. Tsai studied the use of the CCTST to determine if it was superior to the Dental Admission Test (DAT) as a predictor of dental school academic performance; however, the results did not show any difference, perhaps because the DAT reading comprehension and quantitative reasoning tests already measure similar criteria. Newer instruments, such as the Multiple Mini-Interview (MMI), have been deployed to assess the noncognitive domain and have been reported to predict pre-clerkship objective structured clinical examination (OSCE) performance, clerkship performance ratings, and success in the professional domain of licensing examination. Sebok et al. considered critical thinking to be part of the noncognitive domain and reported that the MMI was able to capture the noncognitive traits of medical school applicants, but it was a blunt instrument not able to distinguish between individual traits. Ideally, there would be an instrument to directly measure critical thinking that could accurately predict which potential dental students would be predisposed to and capable of thinking critically and applying critical thinking to clinical situations.

Because problem-based learning (PBL) emphasizes inquiry and the process of problem-solving, it can foster critical thinking. PBL uses clinical cases to prompt students to identify and fulfill their learning needs. Fincham and Shuler found that learning in a PBL-based curriculum allowed students to develop tools for effective problem-solving. Critical thinking not only plays a role in problem-solving, but when it is employed as part of evidence-based practice, it allows students to appropriately apply scientific knowledge in the context of patient care. Students in the dental school patient care environment often encounter complex, multidisciplinary problem-solving situations. Critical thinking, due to its cross-disciplinary nature and emphasis on assimilation and analysis, may be most beneficial in this setting. Williams et al. noted that the clinical reasoning process involves critical thinking in the form of information analysis, inductive and deductive reasoning, and developing treatment plans on the basis of available information. Interestingly, in his review of a critical thinking course at his home institution, Chambers found that expertise in scientific and research methodologies did not by itself translate into an ability to function effectively in the course and that, moreover, a disposition towards critical thinking was not necessary to function in the course or in the clinic. Although Pardamean, by contrast, hypothesized that as students advanced and were exposed to more complex clinical presentations, they would demonstrate a continuous and incremental improvement in critical thinking skills, the results of his research failed to support his expectations.

Since 1997, the University of British Columbia (UBC) Faculty of Dentistry DMD program has employed a hybrid PBL curriculum that emphasizes discovery learning, evidence-based practice, and critical thinking. The biomedical curriculum is centered in the first two years and includes joint lectures with the UBC Faculty of Medicine along with dentistry-specific discovery-type PBL cases. Students not only search for and present new knowledge, but they assess its quality and subsequently discuss it. Assessments, in both small-group settings and on written examinations, are designed to test for application of critical thinking and problem-solving rather than simply recalling information. These assessments include students’ performance regarding their selection and citation of various sources of information, discussion and evaluation of controversial evidence, and arguments and reasoning during group discussions. Another teaching setting where critical thinking is extensively practiced is the evidence-based practice (EBP) module, which consists of a series of non-lecture-based, learning-centered activities in which students learn how to employ EBP principles.
These critical thinking activities foster higher order learning (understanding, applying, analyzing, and evaluating) according to Bloom’s taxonomy. During this multi-component learning process, students are given informal as well as formal feedback to support the development of critical thinking competence. EBP module instructors assess students in the same ways as in the biomedical curriculum.

Overall, we expect our students at the end of the first year and in subsequent years to develop critical thinking skills. In the third and fourth years of the curriculum, students are assigned to clinical practice teams that deliver patient-centered comprehensive care with the support of a dentist who serves as a clinical advisor. Clinical assessments are based on faculty-derived measures of competence guided by the Association of Canadian Faculties of Dentistry competencies. The aims of this study were to describe students’ critical thinking disposition and critical thinking skills at the beginning and end of the first year; examine cohort and gender effects among the cohorts; and relate students’ critical thinking disposition and test scores to their first-year grades. In addition, we were able to retest the graduating class of 2013 at the completion of the program.

Materials and Methods

This prospective study was approved by the UBC Behavioral Ethics Board (H13-00543). In order to assess both students’ disposition to think critically and their critical thinking skills, we opted to use two previously validated instruments: the CCTDI and CCTST tests. The CCTDI consists of 75 Likert-scaled items (ranging from strongly disagree to strongly agree) designed to reflect seven subscales: truth-seeking, open-mindedness, analyticity, systemicity, critical thinking confidence, inquisitiveness, and cognitive maturity. The CCTST consists of 34 multiple-choice items devoid of technical jargon or discipline-specific content; it consists of five subscales: induction, deduction, analysis, inference, and evaluation. Three dental student cohorts—the graduating classes of 2012, 2013, and 2014—were each invited to participate in the study. Each participating student completed both the CCTDI and CCTST at the beginning (within the first week) and at the end (just prior to final exams) of their first year. The testing sessions for each cohort were proctored by the principal investigator (EMW). For the 2012 student cohort, the CCTDI and CCTST administration in year 1 was paper-based, while for all subsequent sessions the test instruments were administered online. When we completed a preliminary analysis of results at end of year one with the three classes, we decided it would be interesting to reassess students’ critical thinking skills and disposition again at the end of the fourth year. While the Class of 2012 had already graduated, we intended to invite the Classes of 2013 and 2014 to participate again just prior to graduation. However, due to an administrative oversight, the Class of 2014 was not invited to participate in the fourth year, leaving us with end-of-program results for only the Class of 2013.

Student year-end grades were chosen as measures of overall performance in the DMD program, while clinical advisor rankings were utilized as a measure of overall clinical success in the DMD program. The clinical advisors are dentist faculty members who work closely with students in each clinical practice cohort over years three and four of the program. The advisors meet weekly as a group to discuss student progress and, as such, were identified as the faculty members with the most complete picture of student progress in all domains through to graduation. Near the end of the fourth year, the advisors were asked to independently rank each student in the graduating class according to five key competencies (professionalism, patient-centered care, communication and collaboration, health promotion, and practice and information management) as being in the highest, lowest, or middle third of the class. The rankings were recorded in a simple tabular form rather than with a validated instrument. Based on grades and clinical advisor scores, students were grouped into tertiles. The clinical advisors were not aware of the students’ final grades, their scores on the CCTDI and CCTST, or the nature of our study. We thus acquired first-year grades for each of the 2012, 2013, and 2014 student cohorts and final-year grades as well as clinical advisor rankings for the Class of 2013. All grades and assessments were compared to the students’ CCTDI and CCTST test scores.

SPSS version 21.0 was used for all tests, and the threshold for statistical significance was set at $p<0.05$. Univariate analyses were used to test the data for normality in preparation for inferential bivariate statistics. As all data were normally distributed, parametric statistics were used for subsequent analyses. The independent sample t-test was used for a non-response analysis and compared mean ±SD of grades between students who participated in the study.
with students who declined to participate. The differences between the combined pretest (during first-year orientation) and posttest (near the end of first-year CCTDI and CCTST) scores and their components were analyzed by means of the related samples t-test. Cohort analyses, intended to compare differences among different year cohorts, included comparisons of the 2012, 2013, and 2014 cohorts by using one-way ANOVA with the Post-Hoc Bonferroni adjustment. To assess whether there were any differences in results between male and female students, gender differences were tested via the independent sample t-test. The first-year grades of the different student cohorts were correlated with the pre- and posttest CCTDI and CCTST scores, applying Spearman’s correlation. The follow-up analysis for the 2013 student cohort employed a related samples t-test associating student baseline CCTDI or CCTST scores or their components with students’ final fourth-year grades and clinical advisor rankings. The inter-examiner reliability of the clinical advisors’ scoring was tested by Cronbach’s alpha.

**Results**

In total, 71 of a possible 134 students participated, for an overall response rate of 53%. For the Class of 2013, there were 23 students who participated at the beginning and 23 at the graduation posttest, but only 13 of them participated in both sessions. No statistically significant differences between the respondents and non-respondents (p>0.05) were found, so the study findings may be applicable to all our dental students.

The results of the comparison of the Classes of 2012, 2013, and 2014 on the total CCTDI and CCTST scores and their components are shown in Table 1. There were no statistically significant cohort effects (p>0.05). When comparing components of the CCTDI scores, a consistent trend for all cohorts was that the highest scores were found for inquisitiveness and the lowest for truth-seeking. On the components of the CCTST scores, students had the highest scores for induction and the lowest scores for analysis.

More detailed comparisons regarding the CCTDI and CCTST scores were also noted. There was substantially more inter-individual variation in the total pretest or posttest CCTDI scores of the 2012 graduating class than the 2013 and 2014 classes. The least variation in the CCTDI scores was observed in the Class of 2014. The opposite trend was observed in the inter-cohort variations in total CCTST scores: the Class of 2014 had more variation in these scores than the 2012 or 2013 cohorts.

Given there were no significant differences among the three cohorts either in the total CCTDI or in the total CCTST scores, the cohort data were combined to test for gender differences in the total CCTDI and CCTST scores and components of those tests (Table 2). Although there were no statistically significant differences on the total CCTDI and CCTST scores, there were some gender differences on the components. Cognitive maturity was slightly higher but marginally statistically non-significant for females (p=0.059), whereas males had statistically higher scores on analysis (p=0.004) and marginally statistically non-significantly (p=0.099) higher inference skills. Figure 1 summarizes the results of the correlation analyses (Spearman’s correlation) when data were combined for all three cohorts and both genders. The pre- and posttest CCTDI total scores correlated marginally non-significantly (p=0.058), while there was a statistically significant correlation between the total pre- and posttest CCTST scores (coefficient=0.462, p<0.001). There was a statistically significant correlation between the total disposition (pretest CCTDI) and the total critical thinking (pretest CCTST) scores. Both the pre- and posttest scores were significantly correlated with student grades at the end of the first year.

The 2013 cohort was retested just prior to graduation. When the clinical advisor rankings and final program grades were used as performance indicators and were related to baseline CCTDI and CCTST scores, a few trends were observed. There were statistically significant correlations between the pre- and posttest scores for both the CCTDI and CCTST near graduation. The Spearman’s correlation coefficient between the pretest CCTDI (baseline year one) and the posttest CCTDI (end of year four) was 0.578 (p=0.039). The corresponding Spearman’s coefficient between the pre- and posttest CCTST scores was 0.630 (p=0.050). Secondly, there were no statistically significant changes in any of the CCTDI components from baseline to the end of the program, except for increased truth-seeking (p=0.016) by the end. None of the CCTST components changed in this cohort from beginning to completion of the program. The comparisons between baseline first-year pretest and posttest scores and final program grades are shown in Figure 2 (CCTDI) and Figure 3 (CCTST). In comparing critical thinking disposition or skills with final grades, a few trends were seen. In the group
with the lowest grades, a substantial inter-individual variation in CCTDI or CCTST at the completion of the final year was observed, while students with final year grades in the upper tertile had the highest CCTDI and CCTST scores at both the beginning and end of the program. The third trend we observed was that there was less variation among student groups in critical thinking disposition or skills at the beginning of the program as compared to the end.

When we analyzed the data for the Class of 2013, these students’ final (fourth-year) grades correlated significantly with their scores on the CCTDI year one pretest (coefficient 0.613, p=0.020), the CCTST year one posttest (coefficient 0.613, p=0.020), and the CCTST year four posttest (coefficient 0.466, p=0.025). There were non-significant correlations between the final program grades and clinical advisor rankings (coefficient 0.339, p=0.058), the CCTDI year one pretest (coefficient 0.313, p=0.156), the CCTDI year one posttest (coefficient 0.182, p=0.593), the CCTDI year four posttest (coefficient 0.134, p=0.542), and the CCTST year two posttest (coefficient 0.393, p=0.165).

There were potential relationships between critical thinking disposition and skills and clinical advisor rankings. Figure 4 shows the students’ distribution according to their first-year critical thinking disposition scores and their clinical advisor ranking in the final year of the program. Students who were ranked in the highest tertile by their clinical advisors also had the highest CCTDI scores at the beginning of the program as compared to students who were

<table>
<thead>
<tr>
<th>Test/Component</th>
<th>Class of 2012</th>
<th>Class of 2013</th>
<th>Class of 2014</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CCTDI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest Year 1 (total)</td>
<td>307.9 28.0</td>
<td>293.2 26.4</td>
<td>311.5 17.0</td>
<td>0.200</td>
</tr>
<tr>
<td>Truth-seeking</td>
<td>38.7 5.4</td>
<td>36.8 4.9</td>
<td>39.3 4.8</td>
<td>0.271</td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>43.5 6.1</td>
<td>41.5 4.2</td>
<td>44.9 2.2</td>
<td>0.093</td>
</tr>
<tr>
<td>Analyticity</td>
<td>46.1 5.1</td>
<td>43.8 6.4</td>
<td>45.5 3.8</td>
<td>0.305</td>
</tr>
<tr>
<td>Systematicity</td>
<td>42.8 6.9</td>
<td>39.5 5.8</td>
<td>41.8 4.9</td>
<td>0.148</td>
</tr>
<tr>
<td>CT confidence</td>
<td>44.1 5.6</td>
<td>43.2 5.5</td>
<td>46.5 4.7</td>
<td>0.173</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>47.5 6.1</td>
<td>45.7 6.0</td>
<td>49.0 3.3</td>
<td>0.173</td>
</tr>
<tr>
<td>Cognitive maturity</td>
<td>45.4 5.4</td>
<td>42.6 6.3</td>
<td>44.7 6.2</td>
<td>0.224</td>
</tr>
<tr>
<td>Posttest Year 1 (total)</td>
<td>303.6 29.5</td>
<td>310.7 24.9</td>
<td>300.2 30.5</td>
<td>0.669</td>
</tr>
<tr>
<td>Truth-seeking</td>
<td>38.4 6.7</td>
<td>39.0 5.8</td>
<td>39.5 5.5</td>
<td>0.875</td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>42.4 5.7</td>
<td>46.1 2.5</td>
<td>43.1 5.6</td>
<td>0.112</td>
</tr>
<tr>
<td>Analyticity</td>
<td>46.5 4.8</td>
<td>45.0 6.1</td>
<td>44.5 6.2</td>
<td>0.523</td>
</tr>
<tr>
<td>Systematicity</td>
<td>41.9 5.6</td>
<td>41.0 6.3</td>
<td>39.0 5.8</td>
<td>0.409</td>
</tr>
<tr>
<td>CT confidence</td>
<td>43.7 6.8</td>
<td>45.5 5.3</td>
<td>45.2 5.7</td>
<td>0.649</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>46.3 5.7</td>
<td>47.5 6.4</td>
<td>45.7 6.8</td>
<td>0.764</td>
</tr>
<tr>
<td>Cognitive maturity</td>
<td>44.6 5.9</td>
<td>46.7 4.2</td>
<td>43.1 7.5</td>
<td>0.362</td>
</tr>
</tbody>
</table>

| **CCTST**      |              |              |              |              |
| Pretest Year 1 (total) | 22.7 4.0 | 21.6 5.6 | 23.8 5.3 | 0.654 |
| Induction | 11.8 2.3 | 11.2 2.8 | 12.5 2.4 | 0.581 |
| Deduction | 10.8 2.2 | 10.4 3.3 | 11.3 3.3 | 0.807 |
| Analysis | 5.3 1.2 | 4.8 1.7 | 5.3 1.5 | 0.851 |
| Inference | 11.0 1.9 | 10.7 3.5 | 11.4 2.5 | 0.331 |
| Evaluation | 6.3 2.2 | 6.1 1.6 | 7.1 2.4 | 0.374 |
| Posttest Year 1 (total) | 24.7 3.7 | 23.5 3.2 | 24.7 4.0 | 0.467 |
| Induction | 12.1 2.3 | 12.2 1.6 | 12.0 3.7 | 0.978 |
| Deduction | 12.6 2.1 | 11.3 2.3 | 10.9 3.5 | 0.115 |
| Analysis | 5.4 0.9 | 5.5 1.0 | 5.3 1.3 | 0.887 |
| Inference | 12.0 2.0 | 12.0 1.9 | 11.4 3.4 | 0.699 |
| Evaluation | 7.2 1.9 | 6.0 1.9 | 6.2 2.8 | 0.176 |

CT=critical thinking; SD=standard deviation

*Note:* Analyses were done with one-way ANOVA with Post Hoc Bonferroni adjustment and independent sample t-test.
ranked by their advisors in the middle or lowest tertiles. Overall, there was an improvement in critical thinking disposition at the end of the first year among students who were later ranked as being in the highest and middle tertiles by the advisors. Students who were ranked lowest by the clinical advisors in the fourth year had the lowest CCTTDI scores at the end of the first year. For critical thinking disposition and skills from the beginning to the end of year one, similar trends were observed. Students who scored highest on the CCTST at the beginning of year one tended to also be ranked in the highest tertile by the clinical advisors near the end of their final year. For the 2013 cohort, overall patterns of critical thinking skills (totals, subscale scores) were similar at the beginning and the end of the first year in all three groups (highest, middle, and lowest rankings by clinical advisors). Further sub-group statistical analysis was not feasible due to the relatively small number of 2013 cohort participants.

Discussion

A commonly encountered problem in research relates to small sample size studies (e.g., underpowered studies due to recruitment challenges) in which trends or differences that are seen are statistically nonsignificant. The importance of not confining reporting and discussion to only those results that are statistically significant has been noted by other researchers. Aronoff explained that “the calculation
of the p-value is directly dependent on sample size; thus the p-value is only a test of significance, not a test that chooses one hypothesis over the other.” McLean and Ernest emphasized that researchers must evaluate the practical importance of results as well as statistical significance.26 As a result, as recommended by Coolican,27 when the probability (p-value) in our study was close to 0.05, we decided to report that it

---

![Graph](https://via.placeholder.com/150)

Figure 1. Overview of combined CCTDI and CCTST cohort scores at baseline (pretest) and near end of first year (posttest) and their relationships to grades at end of Year 1

---

![Graph](https://via.placeholder.com/150)

Figure 2. Correlations between Class of 2013 students’ CCTDI scores in Year 1 and final program grades
Figure 3. Correlations between Class of 2013 students’ CCTST scores in Year 1 and final program grades.

Figure 4. Correlations between Class of 2013 students’ CCTDI scores in Year 1 and clinical advisor rankings at graduation.
approached significance, with the assumption that the level of statistical significance was not reached due to the relatively small sample size.

On the CCTDI subscale, high inquisitiveness suggests intellectual curiosity and a desire to know; however, low truth-seeking suggests that test subjects may not be as willing to commit the effort to fully understand material and ask questions. Higher CCTST induction subscale scores seem to suggest an ability to assimilate material and make inferences, while lower analysis subscale scores may caution that students were not as likely to be aware of the processes and assumptions in making decisions. Higher CCTDI induction subscale scores showed a trend of increased truth-seeking by the end of the program, which suggests that such students are more willing to achieve the best possible understanding of situations.

The results of the first-year CCTST scores, CCTDI scores, and grades in our study appeared to show that the students who entered dental school with higher critical thinking scores tended to complete their first year with higher critical thinking scores and achieve higher grades. These students also showed a greater disposition to think critically at the start of the program. Retesting the 2013 cohort allowed for observation of trends at the completion of those students’ dental education. These trends showed that students who demonstrated an ability to think critically and had a disposition to do so at the start of the program were likely to demonstrate those same attributes at the completion of their training. The CCTDI scores showed a trend of increased truth-seeking by the end of the program, which suggests that such students are more willing to achieve the best possible understanding of situations.

In general, students with the highest grades at graduation were also those who had the highest critical thinking scores at the beginning and at the end of their program. When we combine this trend with the data showing that higher grades at the end of first year were also associated with higher critical thinking skills and disposition scores, it suggests that students who entered dental school with higher prerequisite grade point averages tended to maintain their success. Extrapolating backwards, this finding suggests that dental school applicants who are high academic achievers and who demonstrate high critical thinking skill and disposition scores may be more likely to be academically successful in dental school. Indeed, previous research found that high scores on the cognitive component of the Canadian Dental Aptitude Test predicted high grades in didactic courses. The data from our study appear to show that this is especially true of individuals who entered with higher critical thinking disposition scores. In other words, it appears that our admissions processes should try to identify applicants who are inclined to think critically.

There was an acceptable level of clinical advisor inter-examiner reliability as indicated by the Cronbach’s alpha of 0.797. The clinical advisor rankings also point to the year one pretest CCTDI scores as being an indicator of later success. Since these rankings focus on the noncognitive domain, it seems to suggest that academically high-achieving applicants who are inclined to think critically are also more inclined to demonstrate behaviors associated with professionalism. That said, the clinical inter-rater agreement may reflect some degree of student performance discussion and consensus-building in the clinical advisor pool over the span of the two clinical years.

In contrast to previous studies showing that critical thinking skills instruments were not necessarily better at predicting student performance than other instruments such as the DAT, we did see positive relationships between critical thinking disposition at the start of dental school and both final grades and clinical advisor rankings and between baseline critical thinking skills and clinical advisor rankings. It may be that critical thinking disposition as measured by the CCTDI is the more important measure since it highlights an attitudinal tendency, which may also be part of a larger professionalism domain.

A limitation of our study is its small sample size, as well as having been conducted at only one academic dental institution. Notwithstanding these limitations, we were able to discern some significant trends among critical thinking scores, grades, and faculty rankings. It is possible however that more correlations could have been identified with a larger sample size, particularly with the follow-up of students at graduation. In addition, with a larger sample size, critical thinking skills and disposition subscale scores could be compared with grades in individual dental disciplines; however, that was beyond the scope of our study. Another potential limitation is that it is possible the grades used for comparison in our study may not necessarily be representative of instruments that test critical thinking. Rather, they
may represent examinations that primarily test recall. The effect of this potential confounder, however, may have been mitigated by the rankings of clinical advisors who observed the students in clinical problem-solving settings.

Conclusion

Our study identified some interesting trends that may help to identify promising dental school applicants, showing that high critical thinking scores were associated with success not only in the primarily didactic first year but also in the primarily clinical final (fourth) year. Testing dental school applicants’ disposition and ability to think critically may represent a way forward in identifying those who possess, and will further develop, the skills necessary to apply evidence, judgment, and reasoning to clinical problem-solving. It may also help to identify applicants who, by the end of their training, will be considered to demonstrate the skills associated with the professional (noncognitive) domain. There remains much to learn concerning critical thinking measurement in dental education; however, this study does indicate that it may be helpful in identifying students who can succeed in academic, clinical, and professionalism domains, from the admissions process to the completion of their dental programs.

Acknowledgments

This work was supported by funding from the S. Wah Leung Endowment Fund. The authors would like to thank Ms. Maire Skelly, UBC Dentistry’s Curriculum Manager, and Ms. Connie Reynolds, UBC Dentistry’s Manager of Academic Progress, for their assistance with this study.

REFERENCES
