Correlation of Quantity of Dental Students’ Clinical Experiences with Faculty Evaluation of Overall Clinical Competence: A Twenty-Two-Year Retrospective Investigation


Abstract: The purpose of this study was to investigate the correlation between the quantity of a student’s clinical experiences in the final year of dental school and the student’s overall clinical competence at graduation, as evaluated by faculty at the University of Iowa College of Dentistry. Further, the authors sought to determine whether this correlation changed over time, as new generations of students come to dental school. Information including year of graduation, age at graduation, final grade in the course Clinical Competencies in Comprehensive Care, and final total Clinical Experience Units (CEUs) earned by each student in the D4 Family Dentistry Clinic was collected for 1987–2008 graduates of the University of Iowa College of Dentistry. Spearman’s rank correlation coefficient ($r_s$) was computed for the association of final clinical course grade and final CEU total for each graduation year. The correlation between final course grade and final CEU total was variable, ranging from moderately strong ($r_s=0.614$, Class of 1991) to negligible ($r_s=-0.013$, Class of 2008). This correlation generally tended to become weaker over time. The results of this study suggest that the terminal quality of a dental student’s work is not solely a function of repetitions of prescribed procedures and that repetition of procedures may have even less influence on the quality of clinical performance for the new generation of dental students.

Holmes et al. presented data to support the hypothesis that numerical requirements do not guarantee productivity over a two-year observation period. In fact, this group found that students were more productive (as judged by the completion of more clinical procedures) in a comprehensive care clinical environment as opposed to a procedural-requirement-based system. In the dental literature there is a scarcity of studies that compare the association between the quantity of a dental student’s clinical experience and achievement of overall competence (quality). Studies reported in the medical education literature have noted that the quantity of a student’s experience is not correlated to measures of competence. In a study of 144 medical students at the University of Toronto, Morgan and Cleave-Hogg reported that, while students’ levels of confidence in the performance of specific skills and patient management problems were correlated to the number of times a situation had been encountered or a skill had
been performed, neither clinical experience nor level of confidence was correlated to outcomes in standardized clinical performance assessments. In a study of 227 medical students at the Erasmus University Medical Center in the Netherlands, Wimmers et al. found that an increased number of patient encounters did not directly lead to improved competence. In a report on medical students at the University of Nebraska Medical Center, Beck et al. concluded that knowledge-based examination performance cannot be predicted by the volume of patients seen.

There may be a generational aspect of this question. Neil Howe and William Strauss are well-known speakers and best-selling authors who believe that history shapes each generation depending on what phase of life it occupies as it encounters key historical events and that the characteristics of each generation emerge because the members share a common age-location in history. Much of their writing and presentations have dealt with the “13th Generation” (a.k.a. Generation X, the Baby-Busters: the generation born between ~1961 and ~1981) and the “Millenials” (a.k.a. Generation Y, Generation Next, the Echoboomers: the generation born between ~1982 and ~2000). Howe and Strauss describe seven core traits of the Millennials (special, sheltered, confident, team-oriented, conventional, pressured, achieving). In their 2003 book, Millennials Go to College, they focused particularly on how the traits of the Millennials differ from those of the 13th Generation, and went on to suggest implications of these traits for higher education. Clearly, Howe and Strauss recommend that educators recognize these developments and adapt the curriculum, institutional culture, and learning environment accordingly.

A generational age transformation has been occurring in dental schools across the United States in the past two decades. The life experiences, values, expectations, and behavior of students have evolved from the primarily Generation X dental school student bodies in the 1980s and 1990s to the primarily Millennial student bodies today. In this article, we will consider the hypothesis that generational changes influence the relationship between the quantity of a dental student’s clinical experience and that student’s achievement of overall clinical competence.

The purpose of our study was to investigate, in a longitudinal retrospective analysis, the correlation between the quantity of a student’s clinical experiences in the final year of dental school and that student’s overall clinical competence (quality) at graduation, as evaluated by faculty at the University of Iowa College of Dentistry. Further, we sought to determine whether that correlation has changed over time, as new generations of students come to dental school.

D4 Family Dentistry Curriculum at the University of Iowa

The Family Dentistry curriculum comprises 75 percent of the fourth (D4) year for students at the University of Iowa College of Dentistry. The other 25 percent of the D4 curriculum is comprised of extramural experiences. The D4 Family Dentistry curriculum consists of five courses, each spanning the entire academic year from late July through early June. Three of these (114:184 Dental Practice Management, 114:194 Topics in Family Dentistry, and 114:195 Treatment Planning and Sequencing) are primarily didactic courses. The two clinical courses (114:187 Clinical Experiences in Comprehensive Care and 114:188 Clinical Competencies in Comprehensive Care) carry the most semester credit hours of any courses in the entire dental curriculum.

For the courses 114:187 and 114:188, dental students treat patients for a three-hour clinical session every morning and a four-hour session every afternoon during the final year of the intramural curriculum. The D4 class is equally divided into four groups (approximately eighteen students per group). Each group is supervised by full-time faculty group leaders and approximately six clinical adjunct faculty members. (All adjunct faculty members in the Department of Family Dentistry supervise care one or two full days each week in the Family Dentistry Clinic.) Supervision and consultation are also available from full-time specialty faculty in the disciplines of endodontics, periodontics, prosthodontics, and oral pathology/medicine.

The 187 and 188 courses are concurrent companion courses; assessment in each is based on students’ performance while providing care to the same set of patients under the same supervising faculty. The distinction between these two course grades is intended to discriminate between two elements of professional performance: 1) procedural efficiency/technical production (114:187), and 2) a comprehensive assessment of overall clinical performance (114:188).
Clinical Experience Units

The course 114:187 Clinical Experiences in Comprehensive Care carries eight semester credit hours. To pass the course, students must satisfy attendance standards and complete all clinical procedures on a list of minimum essential experiences. The final course grade is determined by the quantity of a student’s clinical experiences, as measured by the total clinical experience units (CEUs) earned in the Family Dentistry Clinic. Every procedure code recorded on a patient’s visit statement has a number of CEUs assigned to it. Most procedure codes carry a fixed number of CEUs (for example, a two-surface silver amalgam restoration is assigned six CEUs; a porcelain-fused-to-metal crown forty CEUs; a premolar root canal thirty CEUs; etc.). For procedures that are unusually simple or difficult, clinical faculty may add or deduct CEUs on the visit statement. Faculty members and students are advised that, as a rule of thumb, a reasonably organized and efficient dental student should earn roughly six CEUs per hour of patient treatment. Thus, 114:187 (the clinical experiences course) focuses on the quantitative aspects of dental care delivery. This focus is intended to encourage students to gain more clinical experiences and to increase their speed and efficiency in clinical treatment. Students earning a higher CEU total are rewarded with a higher letter grade in the course. At the beginning of their D4 year, the students are presented a grade scale (contract) and a booklet referencing the CEU award for each procedure; they thus know exactly how many CEUs they need to earn in order to achieve their desired grade.

During the twenty-two years considered in this study, the CEU values assigned to individual procedures have remained essentially unchanged. Whenever new procedure codes were added, CEU values were established by considering the existing CEU values for “equivalent” procedures and the six CEUs per hour rule of thumb. Over these twenty-two years, the thresholds for 114:187 grades have gradually increased, due primarily to extension of the academic year and corresponding increases in the number of clinic sessions. The grading scale in the 2007–08 academic year for the 114:187 course is as follows:

- A  Above 5150 CEUs
- A- 5000–5149 CEUs
- B+ 4850–4999 CEUs
- B 4700–4849 CEUs
- B- 4550–4699 CEUs
- C+ 4400–4549 CEUs
- C 4250–4399 CEUs
- D 3600–4249 CEUs
- F 3599 CEUs and Below

In addition to satisfactory completion of specific clinical procedures, students are required to satisfactorily treatment plan and complete comprehensive treatment on seven “major” care and fifteen “minor” care patients in order to receive a passing grade in the course. A single final grade for 114:187 appears on a student’s transcript at the end of the senior year.

114:188 Clinical Competencies in Comprehensive Care

The course 114:188 Clinical Competencies in Comprehensive Care carries more semester credit hours (nine credit hours) than any other single course in the entire dental curriculum at the University of Iowa College of Dentistry. The final course grade is based on evaluation by all clinical instructors who have supervised the student at least one day each week in the comprehensive care (Family Dentistry) clinic during the final year of dental school. Criteria for the final letter grade in this course are published for each of the following areas:

1. Demonstration of sound clinical skills in the treatment of patients.
2. Demonstration of sound clinical judgment in the treatment of patients.
3. Demonstration of preparedness to perform the procedure indicated in patient treatment and proper record management.
5. Demonstration of competent self-evaluation skills and independence needed for the practice of dentistry.

Detailed written grading criteria are reviewed with faculty at the start of the school year and in three subsequent calibration sessions each year. These criteria are printed and attached to the clinical faculty’s daily grading books; this allows for easy reference throughout the clinical session. Grading criteria for course 114:188 are reviewed and refined on an ongoing basis, but the fundamental grading criteria and the careful calibration of faculty to these criteria have not changed during the years included in this study.

Current progress and provisional grades are compiled and discussed together amongst faculty
in grading sessions each ten weeks throughout the course. After each grading session, the faculty group leader provides students with individual feedback regarding current grade status, perceived strengths, and shortcomings. The only grade for 114:188 that appears on a student’s transcript is the final grade for this course, recorded at the end of the senior year. A failing grade in 114:188 requires remediation by return of the student to the third-year specialty block clinics, with direct supervision by specialty faculty, or re-enrollment in the fourth-year clinic with a new, complete set of clinical requirements. It is not possible to graduate with a letter grade of F in this course, as unsuccessful remediation initiates the dismissal process. Perhaps due to this management, intervention, and prior remediation (if needed), it is believed that the grade earned in 114:188 represents the clinical faculty’s most accurate assessment of the student’s clinical competence at the time of graduation. Reviews of the psychometric literature related to competency assessment in health care professions suggest that most authorities consider longitudinal observation of students’ overall performance to be the best predictor of future unsupervised performance.13-15

Methods

Information was collected for 1987–2008 graduates of the University of Iowa College of Dentistry. Data gathered included year of graduation, age at graduation, final grade in the senior-year course 114:188 Clinical Competencies in Comprehensive Care, and final total clinical experience units (CEUs) earned by each student in the D4 Family Dentistry Clinic.

For each graduation year 1987–2008, median value [10th and 90th percentiles reported in brackets] and range were tabulated for age at graduation and for the final grade in the course 114:188 Clinical Competencies in Comprehensive Care (Table 1). Mean value, standard deviation, and range were tabulated for the final total CEUs earned by each student in the D4 Family Dentistry Clinic. Spearman’s rank correlation coefficient ($r_s$) was computed for the association of final 114:188 grade and final CEU total for each graduation year.

Results

Descriptive statistics and Spearman’s correlation coefficients are shown in Table 1. Student age at graduation ranged from twenty-three to forty-six years of age, with the median between twenty-six and twenty-eight years of age for all classes. The span between the 10th and 90th percentiles ranged from four years (Classes of 1994, 1996, 2003, and 2007) to ten years (Classes of 1987 and 1997). Median final grade in the 114:188 course remained consistently in the B to B+ range, with the 10th percentile grades always in the C+ to B- range and the 90th percentile in the B+ to A range. Mean total CEUs earned in 114:187 fluctuated considerably, but displayed an overall trend of increasing slightly through the twenty-two years considered in this study, ranging from a low of 3705 (Class of 1990) to a high of 4763 (Class of 1993).

Correlation between the final 114:188 grade and the final CEU total was variable, ranging from moderately strong ($r_s=0.614$, Class of 1991) to negligible ($r_s=-0.013$, Class of 2008). This Spearman’s rank correlation coefficient is plotted over time in Figure 1. As illustrated by the trendline in this chart, the correlation generally tended to become weaker over time.

Discussion

Although student age at graduation ranged from twenty-three to forty-six years of age through the twenty-two years of this study, the classes were generally homogeneous, with over 80 percent of the graduates each year being between the ages of twenty-five and thirty-six.

One might intuitively expect that the students who performed best in the course 114:188 Clinical Competencies in Comprehensive Care achieved comparable success in the course 114:187 Clinical Experiences in Comprehensive Care. This preliminary assumption may be driven by the notion that, in order to perform at a high level with respect to quality (114:188 course), students would need to have optimized their clinical experiences (114:187 course) and have learned and grown from each experience. This logic is consistent with the historical paradigm of requirement-based curriculum and philosophies in most dental schools in the United States and Canada.16 However, the results of this study do not validate this theory. The data reveal that correlation between final 114:188 grades and final CEU totals were variable, ranging from moderately strong ($r_s=0.614$, Class of 1991) to negligible ($r_s=-0.013$, Class of 2008), suggesting there is not a consistent association between the grades in 114:188 (Clinical
Competencies in Comprehensive Care) and 114:187 (Clinical Experiences in Comprehensive Care).

Absence of any consistent correlation between quality (114:188 Clinical Competencies in Comprehensive Care) and quantity (final CEU total) have led us to hypothesize theoretical constructs for this variable relationship. One explanation may be that the students whose 114:188 grade did not correlate with their final CEU total may have entered the D4 year with a mindset of either placing more emphasis on quality or more emphasis on quantity. The students who placed more emphasis on quality and detail (the ones who did well in the 114:188 course) did not sacrifice their quality product for increased production. These students may have gained many more clinical experiences before going into general practice. These students may have achieved higher CEU totals.

Another viable hypothesis is that students who were not going into postdoctoral programs may have perceived a more urgent need to be productive in their senior year as they wanted to maximize their learning experiences before going into general practice. These students may have gained many more clinical experiences than their colleagues who were going into postdoctoral programs, and as a result may have achieved higher CEU totals.

An interesting observation in the data analyzed was the trend in the Spearman’s rank correlation coefficient to generally become weaker over time (Figure 1). One possible explanation for this phenomenon may be that the more recent graduates, the Millennials, have different generational values with respect to achievement and grades. Howe and Strauss have documented the Millennials’ need for measurements of achievement that are more objective assessments. This generation greatly favors measurements of standardized tests. However, it has also been hypothesized that this generation greatly favors measurements of achievement that are more objective assessments. If this need for objectivity is present and focal, then the...
new generation of students may put more stock in the production grade (114:187 Clinical Experiences in Comprehensive Care) than the more subjective grade (114:188 Clinical Competencies in Comprehensive Care). If this is true, then it would be logical to predict that this trend of lower correlation between quality and quantity grades may be perpetuated with future classes of dental students.

**Conclusions**

The results of our study failed to demonstrate a strong correlation between the quantity of a student’s clinical experiences in the final year of dental school and the student’s overall clinical competence (quality) at graduation. This result suggests that the terminal quality of a dental student’s work is not solely a function of repetitions of prescribed procedures. We are in no way minimizing the importance of repetitions of prescribed procedures in the dental education process, but we feel that in the senior year repetitions alone do not guarantee competence. Other factors contribute to the quality of the dental student’s clinical performance in the D4 year. The interpretation of these results and their implications for implementation and refinement of a competency-based curriculum warrant further investigation.

Over the twenty-two-year study period, the correlation between the quantity of a student’s clinical experiences and the student’s overall clinical competence at graduation generally tended to become weaker. This finding suggests that repetition of procedures may have even less influence on the quality of clinical performance for the new generation of dental students. As Howe and Strauss have suggested, dental schools must adapt their curriculum, institutional culture, and learning environment accordingly.

We are cognizant of the limitations of this study. The data analyzed and presented here are derived from one institution. Historically, the student body

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Figure 1. Correlation between final 114:188 grade and final CEU total: graduating classes 1987–2008

![Graph showing correlation coefficient over time](image-url)
at the University of Iowa College of Dentistry is rather homogeneous, with approximately 75 percent of matriculated students being Iowa residents. Over the course of the twenty-two-year study period, the demographics/socioeconomics and previous life experiences of the students at Iowa may be very different from the demographic/socioeconomic composition of other dental schools’ student bodies. It would be impossible to quantify these differences and their effect on the data. We thus advise prudence when attempting to generalize this data to other institutions.

We are also sensitive to the subjective nature of the 114:188 Clinical Competencies in Comprehensive Care Course. Throughout the course of the twenty-two-year study period, measures have continuously been taken to minimize the subjectivity of the 114:188 course. However, even with the ongoing clarification of competency definitions and the ongoing practice of regular faculty calibration exercises, the 114:188 course still involves a great deal of room for subjectivity, and this may have some influence on the validity and reliability for the measurement of this variable (quality). Nonetheless, our faculty still believes that the grade earned in 114:188 represents the most accurate assessment of a student’s clinical competence at the time of graduation.

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REFERENCES


