Allied Dental Education

Assessment of Students’ Sense of Community in Distance Education Classrooms of U.S. Dental Hygiene Programs

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Abstract: The aim of this study was to examine the association between distance education (DE) and students’ sense of classroom community (SCC) in U.S. dental hygiene programs. The concept of SCC is recognized to have an influence on students’ educational outcomes. With the goal of increasing diversity among future dental professionals, there comes a need to accommodate students of various backgrounds through the use of DE. The impact of DE on students’ SCC has not been studied in previous research. This 2014 cross-sectional survey study looked at a convenience sample of dental hygiene students finishing their first or second clinical year to assess their SCC. Participating programs had both host and satellite campuses and utilized DE for didactic course delivery at the remote sites. To calculate the students’ sense of community, Rovai’s Classroom Community Scale (CCS) was utilized, and demographic information was collected. Six of the 13 eligible programs agreed to participate; the overall response rate for individual students was 25%. When evaluated on their sense of community, the satellite college-based students scored 26.47 CCS units and 14.51 learning subscale units lower than the host college-based students. These results suggested a negative association between the students’ sense of community and their affiliation with satellite campuses when controlled for demographic variables. The findings suggest a negative trend in the SCC for dental hygiene students on remote campuses and utilizing DE for a portion of their curriculum. This trend can potentially decrease students’ educational success and satisfaction and should be addressed.

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Distance education (DE) is one of the most rapidly growing areas in higher education.1 According to the statistical brief published by the U.S. Department of Education, the percentage of students completing their undergraduate degrees with the assistance of some DE classes rose from 8% to 20% in the first decade of the 21st century, and the use of this educational modality reached 22% of all students in health professions education in 2008.2 Some of the driving forces behind this development are students with unconventional backgrounds, which may prevent them from relocating, and students who are older or have family and work obligations.3 A meta-analysis of multiple studies (n=87) from 1990 to 2003 confirmed the existence of numerous DE-based courses in allied health education.3 This study also emphasized the need for continuing evaluation of such distance learning (DL) outcomes as effectiveness, satisfaction, and academic progress. A systematic review of DL in nursing education summarized findings from peer-reviewed publications (n=30) from 1990 to 2004.4 This research revealed that although the DE modality is widespread in nursing education, there is a lack of data about its effects on students’ educational outcomes.

A review article in the Journal of Dental Education recognized the need to explore new learning models and discussed possibilities of DE in address-
ing such difficulties of modern dental education as faculty shortages, economic challenges of teaching institutions, and need for regionalizing dental programs. That research cited few successful projects in implementing DE for the needs of dental education. A study by Andrews and Demps looked at the prevalence of DE in predoctoral dental curricula in the U.S. and Canada. Their findings, based on a 59% survey response rate, were that over half of responding dental schools utilized some form of DE; 11% reported use of a videoconferencing format.

There is limited research dedicated to prevalence and specifics of DL in dental hygiene education. One of the studies, a survey of U.S. dental hygiene program directors (n=225) by Grimes reported that 22% of the programs included some DE classes in their curricula. Furthermore, 13% were considering the addition of DE classes in the near future. Corum et al. reported that 23% of dental hygiene programs were utilizing some form of distance learning in their curricula. In that study, 60% of the full-time dental hygiene faculty members responding described up to 25% of their teaching load as DE-based.

With the use of DE in U.S. dental hygiene programs growing, it is important to evaluate a variety of its effects on students’ success. Students’ sense of classroom community (SCC) is recognized as one area that has an influence on educational outcomes. The aim of this study was to explore an association between dental hygiene students’ SCC and their host vs. satellite location with respect to students’ age, gender, work obligations, physical presence of faculty, and year of studies.

### Student Success with DE and the Concept of Classroom Community

Although research in dental and allied dental education related to DE is limited, other educational fields can offer input on how students’ overall success can be affected by distance learning. Ellison-Bowers et al. described the use of a survey in assessment of learning satisfaction of students enrolled in a single medical terminology course (n=300). Their quantitative analysis revealed no statistically significant difference in student/teacher interactions (p=0.994), course structure (p=0.446), and overall satisfaction (p=0.756) between remote site-based and traditional classrooms. Their qualitative analysis, however, discovered some students at the remote site reported feeling disconnected and lacked a sense of belonging, which affected their educational experience. Furthermore, a comparative study of students’ academic performance associated with face-to-face (n=116) and distance learning (n=269) in a 300-level college course reported lower final grades and higher rates of D, F, and Withdraw grades (p=0.01) for students in the DE course.

Regarding dental and allied dental education, the Grimes survey of dental hygiene program directors reported no statistically significant association between their overall satisfaction with the DE courses and either the length of the program (p=0.795) or the type of distance learning employed (p>0.05). Corum et al.’s survey of full-time dental hygiene faculty members (n=124) returned similar conclusions in terms of satisfaction and acceptance of distance courses. Although these studies were designed to explore the views of the faculty and did not assess students’ satisfaction or academic success, the Corum et al. study suggested an interesting conclusion about the value of students’ engagement during the DE courses. The researchers discussed how increase in interactions positively affects students’ engagement and motivation in a course, thereby predicting better learning outcomes.

It is important to differentiate between evaluation of a single DE-based course and evaluation of a program relying on DE for all its didactic coursework. A longitudinal study of five cohorts of dental hygiene students (n=221) attempted to assess academic success of students completing a program containing DL-based didactic courses. The conclusions suggested no statistically significant difference (p>0.05) between grades or examination results between the host site and distance site groups of students. Nevertheless, academic performance in one of the didactic courses was negatively associated (p=0.03) with students’ remote location. Both academic performance and learner satisfaction have been recognized as parts of a student’s overall success in a course or a program in higher education. One of the main predictors of success, especially regarding educational outcomes of nontraditional students, is the student’s engagement in the learning community. A longitudinal study of a combined sample of dental and dental hygiene students followed six cohorts through transition of a single course from face-to-face to DE-based delivery. In that study, Gadbury-Amyot et al. found no evidence of a negative impact of a negative impact of a DE format on students’
grades and their board exam results. It is important to note that the authors described a significant presence of faculty members via synchronous office hours and question-and-answer sessions. This could have potentially strengthened student-teacher interactions and created a functional online learning community.

For the past few decades, community spirit inside a classroom has been recognized as one of the main contributors to students’ graduation success.15-19 The feeling of belonging, sense of connectedness, and learner-learning environment and learner-instructor interactions are among the important characteristics of an educational process.9,20,21 These traits can be viewed as components of an overall classroom community spirit and, as one study suggests, are important for students’ progress in learning.19 Another study defined a sense of classroom community (SCC) as a feeling of belonging and connectedness between classmates and found that members of strong communities share goals, values, and beliefs and act together to achieve their learning needs.22 McKinney et al. looked at the relationship between the SCC of a single cohort of psychology students and their overall satisfaction level and found a highly positive association between SCC and how students felt about the course (p<0.005) and whether they perceived their learning experience to be successful (p<0.015).19 That study also found a positive association (p=0.029) between higher examination grades and increase in students’ SCC. Unfortunately, the study had a relatively small sample size (n=40). A larger study by Vora and Kinney revealed a statistically significant (p<0.01) negative association between the number of years medical students (n=412) spent at remote locations and their feeling of connectedness and learning satisfaction.22

There is a high demand for DE to be part of dental and allied dental education.5,8,23 In dental hygiene education, as in other health professions education, the emphasis is on teamwork and collaboration, which requires thriving relationships among everyone involved in the process of learning.24,25 When we analyze the evidence, it is important to consider whether the SCC is affected by the students’ affiliation with satellite colleges and their DE approach to didactic courses.

### Methods

Approval for this study was given by the MCPHS University Institutional Review Board with protocol number IRB032114S prior to data collection. The cross-sectional survey study was designed to collect and evaluate data from a convenience sample of students finishing their first or second year of clinical studies in U.S. dental hygiene programs. Only programs with a host site, at least one remote site, and the use of DE for didactic coursework in their remote sites satisfied the inclusion criteria. The American Dental Association’s (ADA) 2011-12 Survey of Allied Dental Education served as the initial source of information about the programs.26

The study employed a web-based tool to administer the survey and demographic questionnaire. The dependent variable of the study was SCC score; the independent variables were affiliation with host or satellite location, gender, age, current employment, year of clinical studies, and amount of face-to-face faculty contact. After IRB approval was received, an email was sent to the dental hygiene program directors whose programs met the inclusion criteria (n=13) requesting their participation. The program directors were asked to forward the implied consent and the survey link to their students.

### Instrument

The study utilized the Classroom Community Scale (CCS) developed by Rovai to measure the SCC in higher education classrooms.27 The scale consists of 20 Likert-type positively and negatively worded questions with options ranging from 0=strongly agree to 4=strongly disagree. (The survey and demographic questions are available from the corresponding author.) Odd-numbered items on the survey related to the feeling of connectedness among members of the classroom community, and even-numbered items investigated the influence of the community on learning. The full SCC score is a sum of all answers weighted; the learning and connectedness subscores are sums of even and odd items, respectively.

The research provided by the originator of the CCS appeared to offer sufficient evidence of the scale’s validity and reliability. The scale was deemed “totally relevant” by a panel of three educational psychology professors and was determined to be easily readable with use of Flesch Reading Ease Score (68.4).27 In addition, two internal consistency evaluations found a reliability range from excellent to good.22,28 The Cronbach’s α was 0.93 for the full scale, 0.92 for the connectedness subscale, and 0.87 for the learning subscale. The equal-length split-half coefficient was 0.91 for the full scale, 0.92 for the
connectedness subscale, and 0.80 for the learning subscale. The tool has been successfully utilized in a variety of academic settings, courses, and programs.  

The only adaptation made for our study consisted of the use of the word “program” in place of the term “course” in the original survey.

**Statistical Analysis**

Using the data collected via the adapted classroom community scale, a “complete-case” statistical analysis was conducted. The complete-case criteria were operationalized as having a response to all 20 Likert-scale questions in the CCS instrument as well as a complete response to the question “Are you a student of a host college or its satellite location?” Returned surveys that had missing data for any of these questions were dropped from the complete-case analysis. Surveys with missing demographic data still met the complete-case criteria. For the complete-case analysis, host student and satellite student groups were compared on several demographic characteristics. Categorical and binary variables were compared between student groups using global chi-square tests of independence, with continuous variables compared using the standard two-sample t-test with equal variances.

Using the scoring key for the CCS survey, we added the results of the 20 Likert-scale questions for each study participant to calculate the CCS raw score (range from a minimum of 0 to a maximum of 80) and the CCS subscale scores on connectedness and learning (each ranging from a minimum of 0 to a maximum of 40). Higher scores indicated a stronger sense of overall classroom community, connectedness, or learning respectively. Univariate and multivariate linear regression models were used to assess the association between CCS raw scores and subscores and student subgroups, controlling for potential confounders via multivariate regression. Regarding model diagnostics, the Shapiro-Wilk test was used to assess data normality, with the Breusch-Pagan/Cook-Weisberg test used to assess heteroskedasticity. An outcome transformation was added to account for negatively skewed residuals and non-constant variance. Sensitivity analyses were conducted to assess the effect of the full-case definition on the regression analyses, using two imputation methods for missing Likert scale data. Additionally, nonparametric Spearman correlation tests were used to assess magnitude and direction of correlations among individual responses in the CCS survey.

**Results**

Six of the 13 eligible dental hygiene programs confirmed their participation by forwarding the email with the survey link to students at the host and remote sites. The programs reported 377 students enrolled: 91 (24%) on satellite campus locations, and 286 (76%) on main campus locations. Although 107 students responded to the survey, only complete surveys were utilized (n=93). Of these 93 respondents, 73% were at host sites, and 27% were at satellite sites; 62.5% were first-clinical year students with 37.5% being second-clinical year students. Table 1 shows demographic characteristics of the sample in relation to students’ affiliations with host or satellite locations.

Univariate regression analysis demonstrated no statistically significant associations between the CCS and students’ affiliation with satellite location (p=0.066) or between connectedness and students’ affiliation with satellite location (p=0.267) (Table 2). However, it showed a difference of -13.47 learning units between students in a satellite location and students at a host school (p=0.019). When controlling for age, work obligations, and year of clinical studies, multivariate regression analysis showed a difference of -26.47 CCS units (p=0.018) and a difference of -14.51 learning units (p=0.004) between students in a satellite location and students at a host school. Sensitivity analyses were also performed to investigate the effect of the full-case definition on the study results. Imputation Dataset #1 was constructed by replacing observations with missing data in the Likert-scale questions with a neutral response to the question. Imputation Dataset #2 was constructed by calculating the average response among complete observations and replacing missing data with the average for the corresponding Likert-scale question. Univariate and multivariate analyses were conducted on Imputation Datasets #1 and #2 and produced very similar results to the full-case analysis.

Additionally, nonparametric Spearman correlation tests showed direction and magnitude of correlation between individual questions on the CCS survey and some of the respondents’ demographic data: age, work hours, year of clinical studies, and amount of face-to-face contact with teaching faculty. Only a few correlations were noted to be statistically significant and of a moderate magnitude. The scores
Discussion

Students who choose distance education as their preferred form of instructional delivery do so for specific reasons. These students may be living in remote communities, have family and work obligations keeping them place-bound, or have other circumstances dictating their choice of a satellite campus instead of a face-to-face educational approach. However, there is a need for these students to be a part of the future allied dental workforce as
they offer much needed diversity to the profession, and there is no reason to perceive them as having less potential for success in the dental hygiene profession than more traditional students. Their educators and college administrators are obligated to ensure these students will receive a quality education while accommodating their unconventional status.

Few studies have been conducted in dental or allied dental education to compare the quality of distance education and face-to-face methods of instructional delivery at the level of a program. Studies in other health care disciplines have highlighted general tendencies for a lower sense of community, a feeling of disconnection, and a reduction in overall students’ satisfaction level. Research in higher education provides evidence of a sense of community influencing the quality of education and learning outcomes. In dental and allied dental education, in particular, a sense of community translates into teamwork and productive interprofessional collaboration and should not be overlooked.

The purpose of our study was to explore if a sense of community in a dental hygiene classroom is influenced by the mode of educational delivery and to investigate whether certain demographic characteristics of students affect their relationships with each other and their educators.

The range of demographic parameters of study respondents can be viewed as fairly representative as it shares similar distribution trends with demographics of the general population of dental hygiene students (Table 4). The conclusions of this research reveal that the SCC can be negatively affected by students’ affiliation with DE-oriented satellite locations of dental hygiene programs. This finding is consistent with the research in other health care disciplines. The consistently negative influence of DE on students’ perceptions of learning is noted as well. Other studies, similarly to ours, suggest that certain demographic subgroups of students at satellite campuses experience a lack of caring and a feeling of uncertainty in their learning environment. Some participants at remote sites have reported a lack of encouragement in regard to learning—an observation similar to existing research on DE in other educational fields. Another study related stronger learning outcomes with fewer hours worked per week by satellite students. Fewer work and family obligations create opportunities for students to be more invested in their education.

Overall, our study appears to offer a sufficient amount of evidence to address our hypothesis. However, there were some significant limitations. First

Table 3. Strength of correlations between selected survey questions and students’ demographics filtered by campus location

<table>
<thead>
<tr>
<th>Question</th>
<th>All Students</th>
<th>Host Students</th>
<th>Satellite Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of studies correlation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I feel that students in this program care about each other.</td>
<td>-0.288*</td>
<td>-0.214</td>
<td>-0.479*</td>
</tr>
<tr>
<td>17. I feel uncertain about others in this course.</td>
<td>0.170</td>
<td>0.074</td>
<td>0.446*</td>
</tr>
<tr>
<td>Work hours correlation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I feel that this program results in only modest learning.</td>
<td>-0.124</td>
<td>-0.012</td>
<td>-0.449*</td>
</tr>
<tr>
<td>Age correlation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. I feel that this program does not promote a desire to learn.</td>
<td>-0.071</td>
<td>0.043</td>
<td>-0.403*</td>
</tr>
</tbody>
</table>

*Statistically significant at p<0.05

Table 4. Demographic characteristics of U.S. dental hygiene student population, 2011-12 and 2012-13

<table>
<thead>
<tr>
<th>Variable</th>
<th>2011-12</th>
<th>2012-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 and under</td>
<td>46.3%</td>
<td>46.4%</td>
</tr>
<tr>
<td>24-29</td>
<td>32.2%</td>
<td>30.5%</td>
</tr>
<tr>
<td>30-34</td>
<td>10.5%</td>
<td>11.1%</td>
</tr>
<tr>
<td>35-39</td>
<td>5.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td>40 and over</td>
<td>4.0%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Unknown</td>
<td>2.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Female</td>
<td>96.0%</td>
<td>95.8%</td>
</tr>
<tr>
<td>Job and/or family care responsibilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>57.7%</td>
<td>58.7%</td>
</tr>
<tr>
<td>No</td>
<td>42.3%</td>
<td>41.3%</td>
</tr>
</tbody>
</table>

are the limited variability and small sample size. The original source of information, the ADA report, incorrectly listed some dental hygiene schools as having satellite DE-based campuses and did not mention a number of dental hygiene programs potentially qualified for this research. As the updated report becomes available, this problem can be resolved, leading to more data being collected.

The study results also have limited potential to be reflective of the entire field of allied dental education due to the specific approach to DE delivery used by the satellite-based programs. Another barrier to generalization is the limited number of programs agreeing to participate since only 46% of the total took part in this study. Although geographically the participants were a reasonably representative sample and included programs located in the West, Midwest, South, and Northeast, distinctive characteristics of regions and programs make it difficult to generalize the findings. In addition, it is important to point out that the study sample distribution was skewed towards the host college-based students. Although the data provided by program directors described similar distribution among their students, this trend can be viewed as bias towards opinions of the non-DE students.

Regrettfully, it was not possible to contact students directly due to the programs’ compliance with the Family Educational Rights and Privacy Act (FERPA). Communication with participants through their program directors did not allow for a better assessment of the sample. To address these problems, future survey design should include regional markers and allow for more data collection time. The revised survey should also include such features as incentives and regular reminders. According to some research, these strategies can increase the odds of a response by as much as 30% without compromising the quality of data. Regarding the limited variability of the study sample, it is also worth mentioning there was a zero response rate from male dental hygiene students. Due to the general prevalence of females in the profession (Table 4), the response rate for males was expected to be low. However, a complete lack of male representation in the surveyed sample may be viewed as another challenge for generalization of the study. Finally, another issue observed was incomplete responses, particularly to the demographic questions added to the original CCS survey. To increase the response level, the readability and ease of comprehension for those questions need to be evaluated more carefully.

If these limitations are addressed, it could make the replication of this research more successful, which would lead to more valid and generalizable conclusions and provide much needed evidence for program directors and faculty members. More reliable results could influence curriculum design and offer a framework for revisions of DE methodology in dental and allied dental education. It is obviously advisable to identify interventions that increase a sense of community in dental hygiene classrooms, but a larger dataset would provide more information to use in choosing and designing such interventions.

Conclusion

The results of this investigation suggest that distance education, although viewed by previous research as a significant step forward in accommodating the needs of higher education, can negatively affect important aspects of students’ educational experience such as the feeling of community in some distance education classrooms. This study underlines a number of concerns about the distance education option offered as a part of some U.S. dental or dental hygiene programs and supports the need for more research on this topic.

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