Facilitating Advanced Research Skills Beyond the Undergraduate Dental Hygiene Curricula

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Abstract

Purpose: Dental hygiene educators play a key role in assisting students to make connections between research and clinical practice. A core course in research was redesigned with the goal of motivating and encouraging dental hygiene students to advance research skills beyond the undergraduate dental hygiene curricula. The purpose of this pilot study was to evaluate the redesigned course and the student outcomes as they relate to perceived barriers and motivation for future research in dental hygiene.

Methods: A 25-item, electronic survey composed of 3 sets of Likert scaled questions was sent to a convenience sample of Bachelor of Science dental hygiene students (n=18) enrolled in the Introduction to Research Methods course at New York University. The survey explored students' perceptions of satisfaction with the learning strategies used as well as motivations and barriers toward future research. In addition to the survey, the final project, overall course grade and university end-of-course evaluations were examined to gain a comprehensive understanding of course effectiveness. Descriptive statistics were used to analyze data.

Results: Of the 18 students invited to participate, 12 completed the course evaluation survey(n=12) for a 67% response rate. Results indicated that all respondents learned about the research process and an Institutional Review Board (IRB) proposal. Most respondents indicated interest in taking additional research courses and in conducting future research. While students indicated lack of time as a barrier toward pursuing research (41.7%), they valued the need for research in clinical care. The IRB proposal project mean score was 88.3 % and the overall mean grade was 89.5%. On a Likert scale range of 1 (low) - 5 (high), the university end-of-course evaluation indicated a 4.9 overall course satisfaction.

Conclusion: Results from this pilot study reflected positive students' attitudes towards the redesigned learning modalities and indicated future plans for conducting research upon course completion.

Key words: dental hygiene students, dental hygiene research, dental hygiene curriculum, online learning

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Introduction

Advocating the role of dental hygiene research

Research plays a key role in dental hygiene education and the advancement of the dental hygiene (DH) profession.[1-4] The American Dental Hygienists' Association (ADHA) has had policy since 1970 advocating the role of dental hygienists in research, including their contributions to interdisciplinary studies and practice.[5] In addition to ADHA policy, the National Dental Hygiene Research Agenda (NDHRA) acknowledges the importance of a body of knowledge unique to DH when defining it as a profession and developing it into a discipline.[6-7]

As a discipline, dental hygiene must continue to generate a knowledge base that is unique to the profession. As future professionals begin the education process, dental hygiene educators play a key role in assisting students in making the connection between research and clinical practice. Learning about the research process and understanding its impact on clinical practice can also serve to inspire students to conduct their own research and contribute to the growth of the profession.

Current curricula in associate and baccalaureate programs

Research has been broadly defined in dental hygiene education standards. While the American Dental Association

Commission on Dental Accreditation (CODA) Standard 2-22 states that dental hygiene graduates must be competent in the evaluation of current scientific literature, specific courses in research methodology or original research projects are not required in meeting the standards. Research is included in CODA Standard 1-1 which states "programs must demonstrate its effectiveness using a formal and ongoing planning and assessment process that is systematically documented by developing a plan addressing teaching, patient care, research and service."[8] Key to this standard is the ability of the institution to integrate research into the curriculum that is appropriate for their education setting.

An integrated research curriculum must be provided during professional education to promote future research, in addition to promoting skills to advance the profession. According to Fried et al. instruction in research lays the foundation for evidence-based decision making and the skillsets required for a dental hygiene workforce that is integrated into multidisciplinary teams.[9] In spite of what is known about the benefits of incorporating research into the curriculum, there are challenges at the undergraduate level. In a study of the motivations and challenges towards research, Partido and Colón found the most frequently cited barriers were lack of time, lack of funds to conduct research projects, lack of formal research courses in curriculum and an overall lack of interest in research.[10] However, participants also cited the benefits of research to patient care, understanding research terminology, and the development of transferable skills and competencies for a clinical career. Significant positive relationships were shown between participation in formal research activities and research courses.

Partido and Colón concluded that there is a need for more support of students in research activities to overcome perceived barriers to performing research.[10]

Undergraduate research course redesign

Accreditation standards and competencies can be met through a variety of educational degrees and curriculum plans. In the Department of Dental Hygiene and Dental Assisting at New York University (NYU), CODA Standard 1-1 requirements regarding research are met from a myriad of activities dispersed in courses throughout the Associate in Applied Science (AAS) curriculum. Students learn to create Problem, Intervention, Comparison, and Outcome (PICO) questions, search and review literature, create abstracts, and present research posters in the AAS curriculum. The Introduction to Research Methods (IRM) was designed to build upon the CODA standard and skills for the entry-level learner and provide additional research opportunities to meet diverse student needs. This NYU Bachelor of Science (BS) research course had always been an in-person, required core course offered in the third year of the four-year curriculum. The NYU Department of Dental Hygiene and Dental Assisting offers numerous curriculum tracks to meet the needs of a diverse student body. In addition to the 78-credit Associate in Applied Science degree program, there are three BS tracks with an advanced set of required courses for the BS degree. The BS program can be completed as a four-year integrated program from freshman to senior years, a 3-year accelerated track for transfer students, or as degree-completion track (DHP) after the associate degree is completed. Students enrolling in the IRM course would have completed the prerequisite statistics course along with the entry-level AAS/AS curriculum.

Historically, the IRM course has been co-sponsored by the Department of Nursing and was taught to cohorts of dental hygiene and nursing students in a face-to-face classroom setting. The nursing sponsored course, although positive for interprofessional learning, created numerous scheduling conflicts resulting in delays in registering for this required course. The research content was focused more towards nursing practitioners; therefore the decision was made to create a research methodology course exclusively for dental hygiene students enrolled in the BS degree program. The course was redesigned for delivery by the Department of Dental Hygiene and Dental Assisting through the NYU learning management system, an online Sakai based platform with the full range of tools for discussion forums, testing, Zoom links, and access to university resources, such as the library. The redesigned IRM class was delivered asynchronously, similar to other courses in the DH BS program.

As a newly revised course, the course directors were able to establish course goals and learning activities at a level higher than the required CODA standards and to address the ADHA NDHRA priority areas. These learning activities allowed students to practice skills in critical thinking and research methodology. The activities included responding to forum questions and discussions, answering knowledge checks, completing internet-based assignments, creating PICO questions, developing research designs and creating a research final project as part of an institutional review board (IRB) application to demonstrate the culmination of skills and competencies. The course goals are presented in Figure 1. Given the newly designed course goals and learning experiences, the program faculty wanted to evaluate the course for advancing student research skills and meeting the course goals. The purpose of this study was to evaluate a redesigned introduction to research methods course and

the student outcomes as they relate to perceived barriers and motivation for future research in dental hygiene.

Figure 1. Introduction to Research Methods Course Goals

Use scientific research in problem solving and critical decision making for all professional activities.
Identify the process for developing clinically relevant questions and selecting a research topic.
Define research; explain and apply research terms; describe the research process, designs, and the principle activities, skills and ethics associated with the research process.
Develop information literacy skills for locating the best available evidence.
Identify and explain the difference between quantitative, qualitative, and mixed methods.
Read, interpret, and critically evaluate health research.
Describe how evidence-based practice shapes the health care professional's role in the private practice setting and community.
Construct a coherent research proposal that includes an abstract, introduction, literature review, research questions, ethical considerations, and methodology.

Methods

This course effectiveness study began following completion of the spring 2020 IRM course. This study was given the status of exempt by the Institutional Review Board of NYU (IRB-FY2020-4310). While the demographics and previous educational backgrounds of the 18 registered students were known to the researchers, no identifying characteristics were matched the survey responses regarding the demographics. All students previously had a course in statistics as a prerequisite to registering for the IRM course. The sample population was all 18 students registered for the IRM course in Spring 2020. Students were in their third year of the baccalaureate program or in the third year of the accelerated BS track for transfer students, or in the degree completion track. The IRM course evaluation for this study was composed of two aspects; that of the faculty created survey of the course learning strategies and the student attitudes of motivation and barriers, and the end-of-course university survey.

Survey instruments

The first instrument was a 25-item electronic survey named Introduction to Research Methods course evaluation (IRMCE) and was delivered using an online survey software program (Qualtrics version 2020; Provo, UT, USA). Two external lay readers and two dental computer experts reviewed the survey for face validity of readability, question style, and clarity. Minor changes were made based on the feedback and the survey was distributed after the close of the semester. The survey was organized into four sections. The first section assessed general aspects of research including number of taken research courses, course helping with learning the research process and course helping construct a mock IRB proposal. The other sections assessed satisfaction with learning strategies including forums, discussions, and the final course project, (nine items), motivations (five items) and potential barriers in conducting future research (7 items). Satisfaction with the learning strategies was assessed using a five-point Likert scale from extremely satisfied to extremely dissatisfied and motivations toward research was assessed with a five-point Likert scale of definitely yes to definitely no. Barriers toward research were assessed with a five-point Likert scale of strongly agree to strongly disagree.

Each section was analyzed for internal consistency and the learning strategies section was reliable with standardized Cronbach's Alpha of 0.621. The perceived motivation section had a higher standardized Cronbach's Alpha of 0.890 and the perceived barriers about research had the highest standardized Cronbach's Alpha of 0.91. The internal consistency results indicated that the survey met the requirements of reliability and validity.

All students enrolled in the course were encouraged to respond and there were no exclusions to participating. Informed consent was provided through the unique IRMCE login.

In addition to the IRMCE survey, the investigators assessed the NYU end-of-course evaluation. These 12 questions provide the formal, ongoing modality to assess courses across the university. The survey questions were available to all 18 registered students at the end of the term but were not visible to faculty until the posting of grades. Items relevant to the IRM course are shown in Table V; the Likert scales ranged from 1-5, with 5 indicating strongly agree. Descriptive frequencies were used to evaluate the results of the IRM course evaluation survey items and assessed the means of the end-of-course evaluation. Descriptive statistics were used to analyze the investigator designed IRM survey and the NYU end-of-course evaluation.

Results

Participant demographics indicated that all were females registered in the baccalaureate program (n=18); either in the third or fourth year of the BS program (n=13) or in the BS degree completion program (DHP) (n=5). Participants' ages

ranged from 20 to 59 years, with a mean age of 29.8 years and a median of 26 years (Table I). Of the students invited to complete the IRMCE survey at the course conclusion (n=18), 14 responded; but only 12 completed the survey for a 66.7% response rate (n=12). The IRM course was the first research course taken by most respondents (n=10). All respondents strongly agreed that the course helped them learn the research process. Respondents also strongly agreed that the course helped them learn about constructing a research proposal. Most respondents felt the IRM course changed their view of research "a great deal" (n=9). The course project mean score was 88.3 % and overall course mean grade was 89.49%. Grades in the course ranged from C to A, with one remediated C/F. Grade distribution matched the normal curve of student achievement, with only one in the lower achievement grade categories (Table I).

Learning activities, motivations, and barriers to future research were assessed with descriptive statistics. The nine learning activities items indicated that knowledge checks, textbook readings, assignments using a dental learning website, and final project were rated more highly than the other learning activities. The students were more divided on responses for the forum activities and final examination (Table II). At least half the respondents indicated that they would consider future activities in research and would either definitely (n=4) or probably (n=8) take another research course. Respondents were also open to conducting future research and possibly publishing work in a peer reviewed journal. Respondents were divided about pursuing a research focused career. Responses to future interests and motivation towards research are shown in Table III. Respondents were asked to rate barriers towards conducting research with seven

Table I. Demographics (n=18)

Age							
18-23	18-23	24-29	30-34	35-39	40-44	45-49	50+
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
	6(33)	5(28)	4(22)	1(5)	—	—	2(11)
Year in BS Program	**1st**	**2nd**	**3rd**	**4th**	**Degree completion**		
	—	—	7(39)	6(33)	5(28)		
Grades	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Course grade	5(28)	5(28)	4(22)	3(17)	—	—	1(5)
Course project	5(28)	2(11)	2(11)	7(39)	—	2(11)	—

Table II. Satisfaction with learning activities (n=12)

	Extremely satisfied	**Somewhat satisfied**	**Neither satisfied nor dissatisfied**	**Somewhat dissatisfied**	**Extremely dissatisfied**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Knowledge checks	9(75)	3(25)	—	—	—
Discussion with others	9(75)	2(16.67)	1(8.33)	—	—
Forum activities	9(75)	2(16.67)	—	1(8.33)	—
Assignments	11(91.67)	1(8.33)	—	—	—
Research project draft	9(75)	3(25)	—	—	—
Final version research project	12(100)	—	—	—	—
Final examination	8(66.67)	3(25)	1(8.33)	—	—
Self-evaluation	9(75)	3(25)	—	—	—
Textbook and readings	10(83.33)	1(8.33)	1(8.33)	—	—

items ranging from lack of interest and time to disliking the complexity of research. Over half (66.7%, n=8) of the respondents did not feel that a lack of interest in research was a barrier, however lack of time and lack of support were identified as issues (Table IV).

Seven of the registered students (n=7) completed the 12 item NYU end-of-course evaluation, for a 39% response rate. A Likert scale of 1-5 indicated a 4.9 overall course satisfaction. The standard questions included the overall evaluation of the course, whether course objectives were clearly stated and if the course was well organized, intellectually stimulating with content that was valuable and worth learning (Table V).

Table III. Motivation toward research (n=12)

	Definitely yes	Probably yes	Might or might not	Probably not	Definitely not
	n (%)	n (%)	n (%)	n (%)	n (%)
Taking more classes in research	4(33.33)	8(66.67)	—	—	—
Conducting research	3(25)	8(66.67)	1(8.33)	—	—
Presenting a poster at a research conference	4(33.33)	5(41.67)	3(25)	—	—
Publishing articles in peer reviewed journals	3(25)	4(33.33)	4(33.33)	1(8.33)	—
Commencing a research-focused career	4(33.33)	2(16.67)	4(33.33)	2(16.67)	—

Table IV. Barriers towards research (n=12)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
	n (%)	n (%)	n (%)	n (%)	n (%)
Lack of interest in research	1(8.33)	2(16.67)	1(8.33)	6(50)	2(16.67)
Lack of time	2(16.67)	4(33.33)	2(16.67)	3(25)	1(8.33)
Lack of support	2(16.67)	3(25)	1(8.33)	4(33.33)	2(16.67)
Research is not important for clinical careers	1(8.33)	1(8.33)	1(8.33)	1(8.33)	8(66.67)
I dislike the scientific complexity of research	1(8.33)	0(0)	3(25)	4(33.33)	4(33.33)
Lack of current knowledge (need more courses)	2(16.67)	12(16.67)	3(25)	3(25)	2(16.67)
Poor writing skills	1(8.33)	3(25)	1(8.33)	5(41.67)	2(16.67)

Discussion

The research methods course in the NYU BS degree program was redesigned from an in-person class delivered by the School of Nursing to an online class within the Department of Dental Hygiene and Dental Assisting and included objectives specific to dental hygiene. Results from this pilot study provided insight on the redesigned course and student outcomes as they relate to perceived barriers and motivation for conducing future research in dental hygiene. The redesigned IRM course was delivered asynchronously online. Methods for online courses vary extensively given the institutional platform, administrative support, and faculty expertise; these considerations have been discussed in previous studies.[11-15]

Transitioning a course to an online platform was not a simple pedagogical process; specific learning strategies were developed to ensure success in the application of research skills. Effort was made to maintain student contact in an asynchronous delivery format. Online courses also require learning activities that address the course goals yet individualize and monitor learners' competencies. The IRM faculty established feedback and contacts to each student through the forums, draft project consults, and direct email. Students who were falling behind were contacted and the department student advisor was notified for further follow-up.

One key result of the pilot study was the highlighted effectiveness of the personalized contact from faculty. The required one-on-one meeting to review the IRB proposal project was noted

Table V. End-of-course evaluation: Introduction to Research Methods (n=7)

End-of course evaluation: Spring 2020	Mean score range 1-5
Overall evaluation of the course	4.9
Course objectives clearly stated	4.7
Course well organized	4.9
Course was intellectually stimulating	4.9
Topics organized in coherent manner	4.7
Content is valuable and worth learning	4.9
Assignments emphasized understanding	4.9
Rate course materials	4.7
Examinations emphasized material covered in course	4.7
Course uses fair grading procedures	4.9
Amount of course work is heavier than other courses	4.1
Overall rate quality of course content	4.6

as extremely successful by the respondents. This session provided a greater understanding of the project requirements and provided faculty with the opportunity to give direct feedback and additional support in guiding the research proposal. These strategies also served to motivate the students and overcome their personal fears for the projects. The use of online activities from corporate sponsored educational programs, exercises from the research textbook,[16] and online videos for reviews of statistics and research methodology, proved useful in delivering content. Planning for future learning experiences should take into account access to the internet, faculty time for virtual conferences, effective use of virtual meeting platforms, and built-in structures for small group interactions or meet-ups. These concepts were previously assessed in a NYU study[17] which helped guide the IRM course designers.

Textbook chapters[16] were assigned for weekly readings and students were required to complete knowledge checks by the end of the week. Most of the respondents indicated that they were satisfied with the textbook and the knowledge checks, and it appears that these regularly scheduled activities had a positive effect on student learning, especially for a fully online course. Forum topics modeled the readings and were designed to apply the material prior to completing the knowledge check and most respondents were either extremely satisfied (75%) or somewhat satisfied (16.7%) with the concept of discussions with others. Some students held back on posting discussion comments until many other students had posted and it appeared that there was some confusion regarding the assignment or the basis for the discussion. It was noted that students expressed pleasure when a faculty member responded to their posts or posted additional information for the class. For future planning, the faculty might present clearer instructions regarding the discussion topic and the required process for the activity.

The IRB proposal project was designed for students to apply their knowledge in defining a research problem, study purpose, design, methods, analysis, and ethical concerns to a research proposal. Students were required to frame a research question that was at a higher level than previous course work and required a more extensive search of the literature. The greatest challenge most students faced was clarifying a research question and determining the appropriate study design to test the hypothesis. Faculty was available to advise and redirect students in the online forum postings. This finding is similar to Partido and Cohen who identified the need for faculty support to help overcome barriers faced by student researchers.[10] Faculty feedback throughout the IRM course helped to solidify student learning prior to the final project allowing for students to explore research methods as undergraduate students, while also establishing skills for future research as graduate students.

Motivation to pursue future research was included in the course evaluation and results indicated that the respondents had acquired enough information to consider conducting research in the future. While the respondents may not have perceived publishing future research, they were more inclined to consider making a presentation at a research conference. Additionally, the respondents overwhelmingly valued the need for research in clinical care, similar to the findings of Partido and Colón that conducting research contributes to patient care and a motivation for future research among students.[10] The course goal to describe how evidence-based practice shapes the role of the health care professional was indicated positively in the findings.

Across all of the BS degree program selections, respondents seemed to indicate that they needed more courses in research and only a minority (8.3%) stated that they disliked the scientific complexity of research. Given the responses indicating that research is important in clinical careers, dental hygiene programs could consider adding additional course material to with this research focus or internships to apply the learned skills.

The university end-of-course evaluations are routinely used by the program curriculum committee as part of a bi-annual review. The low number of respondents restricts interpretation and application of the end-of-course results to this pilot study. Based on the 4.9 score, it may be inferred that the redesigned course was successful for the respondents. The DH department and IRM course faculty did not have access to previous end-of-course reviews from the previous course delivered by the nursing department for comparison. Overall, the course grades indicated that the students successfully navigated the course. The grade range of A to C aligned with other baccalaureate courses in the dental hygiene program.

As oral health care providers, all dental hygienists need fundamental research skills and the IRM course provided avenues to advance those skills. For most students this was their first formal research course.

Hopefully students will continue in a dental hygiene focused research path, apply the skills to evaluating the literature and thereby enhancing evidence-based decision making, and ultimately enriching our professional role in research. Current clinicians can consider these avenues for continuing education to enhance their research skills for the same goals of critical thinking and decision making.

Limitations

This study had limitations. The non-probability and small convenience sample size limits the generalizability of the findings. Social desirability bias may have influenced the survey responses. While the course had been completed and grades posted, students may have inflated their opinions towards the faculty and for the course. The survey also lacked a qualitative aspect. Participants may have been inclined to add comments or explanations if given the opportunity. Future cohorts should be evaluated and compared. Combined study results may yield further information for institutions planning research courses. Future studies should investigate whether students take additional methodology courses, conduct original research studies, and submit manuscripts for publication, indicating further success of the goals for the course.

Conclusion

Results from this pilot study showed that an innovative online research course for baccalaureate degree dental hygiene students was effective in developing advanced research skills. The active learning strategies provided practical knowledge and experiences that may inspire students to perform research that will expand the dental hygiene body of knowledge. This course can serve as a model for developing higher level research skills and ultimately advance the profession.

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