

Developing Interprofessional Education at One U.S. Dental School: Establishing a Baseline and Moving Forward

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Abstract: Dental schools across the U.S. are in the process of incorporating interprofessional education (IPE) into their curricula. At Louisiana State University Health Sciences Center-New Orleans (LSUHSC), the process of educating competent students fully prepared to maximize patient outcomes through interprofessional care is under way. The aim of this study was to establish baseline data on three years of LSU dental students' perceptions of IPE prior to and as a new two-year IPE curriculum was being introduced. A survey was conducted of dental students in all four years from 2015 to 2017 using the Student Perceptions of Interprofessional Clinical Education-Revised instrument, version 2 (SPICE-R2). In 2015, 120 students participated in the survey for a response rate of 46%, followed by 160 students in 2016 (62%) and 170 in 2017 (67%). The results showed that the first-year students in 2017 had a higher total SPICE-R2 mean score than the first-year students in 2015 and 2016; the difference was statistically significant. Even though the 2017 first-year students had only received an orientation to the curriculum at the time they completed the survey, this change in attitude suggests the new focus on IPE was already having an effect on students. There were no statistically significant differences between mean scores for the three cohorts of second-, third-, and fourth-year students, none of whom had experienced the new IPE curriculum. Data from this study will serve as a baseline from which to evaluate the impact of the new IPE curriculum that is now required of all first- and second-year dental students. Through continued IPE exposure in the curriculum and ongoing faculty development, further improvements in students' attitudes toward IPE can be anticipated.

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Interprofessional education (IPE) is defined as occurring when “students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes” (p. 7).¹ The American Dental Education Association (ADEA) has been a pioneer in increasing awareness of and supporting IPE and interprofessional collaborative practice (IPCP). ADEA is one of the six inaugural members of the Interprofessional Education Collaborative (IPEC). In 2011, IPEC released an expert panel report that defined four core competencies and 38 subcompetencies to guide

interprofessional learning.² In 2016, the subcompetencies were updated to promote population health, and one new subcompetency was added.³ The IPEC report has guided the development of IPE at Louisiana State University Health Sciences Center-New Orleans (LSUHSC-NO).

LSUHSC-NO is comprised of the Schools of Allied Health Professions, Dentistry, Graduate Studies, Medicine, Nursing, and Public Health. The School of Dentistry (LSUSD) educates students in dentistry, dental hygiene, and dental laboratory technology. It is the only school in the U.S. to have

training for these three professions under one roof. As a result, it has a unique history of intraprofessional education in dentistry, which has aided its development of IPE. The aim of this study was to establish baseline data on three years of LSU dental students' perceptions of IPE prior to and as a new two-year IPE curriculum was being introduced. These data will be used to assess future outcomes of the new curriculum and help the institution chart its way forward regarding IPE.

IPE History at LSUHSC-NO

The impetus for much of the IPE-related activity at LSUHSC-NO stemmed from ADEA leadership activities. In academic year 2010-11, Dr. Sandra Andrieu, associate dean for academic affairs at LSUSD, was the ADEA president, and her platform championed the inclusion of oral health professions in IPE. She also brought her enthusiasm for the topic to LSUHSC-NO and established a grassroots working group in 2011. Faculty from five of the six LSUHSC-NO professional schools (Allied Health Professions, Dentistry, Medicine, Nursing, and Public Health) initiated a discussion regarding IPE development, and in 2012, central administration appointed a formal IPE Committee to expand initiatives.

The goal of the IPE Committee was for each student to have at least one IPE experience while enrolled at LSUHSC-NO. Initially, the committee developed and implemented an elective course open to all students across all schools regardless of training level. The focus of the elective course was to increase awareness, knowledge, and application of IPCP. From 2012 to 2016, the elective course was offered during the fall semester. A total of 348 students from 19 programs enrolled in the elective course over a period of five years. Of those students, 91 were fourth-year dental students.

During the summer of 2013, LSUHSC-NO started its preparations to develop the institution's Quality Enhancement Plan (QEP). The QEP was a required component of the institution's reaffirmation of accreditation by the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC), a regional body that accredits degree-granting higher education institutions in the U.S. The focus of the QEP was IPE, and SACSCOC approved the QEP in March 2015 with encouragement to include all six LSUHSC-NO schools.

A literature review reported that financial support, establishing organizational structures, and providing faculty development programs are institutional enablers for successful IPE programs.⁴ One of the three main QEP goals was to establish an infrastructure to support IPE activities. In April 2015, LSUHSC-NO established a Center for Interprofessional Education and Collaborative Practice (CIPECP). The goal of the CIPECP is to coordinate student education by utilizing a team-based, patient-centered approach across all LSUHSC-NO schools and programs.

Initially, the CIPECP gathered accreditation standards related to IPE from all schools and programs. The Commission on Dental Accreditation (CODA) has two specific standards incorporating interprofessional interaction for predoctoral dental education programs. Standard 1-9 states, "The dental school must show evidence of interaction with other components of the higher education, health care education, and/or health care delivery systems," and Standard 2-19 states, "Graduates must be competent in communicating and collaborating with other members of the health care team to facilitate the provision of health care."⁵

IPE Faculty Development

Prior to establishment of the CIPECP, LSUHSC-NO's Teaching Academy supported faculty development in its 2012 spring symposium dedicated to IPE. The symposium assisted in the initial faculty engagement and establishment of a small group of faculty members interested in IPE. From the spring symposium, three LSUSD faculty members emerged who were immersed in development of the IPE elective and served as facilitators for small group discussion in the IPE elective.

Faculty support and participation in IPE has increased over the past seven years, resulting in 21 trained LSUSD faculty members. The increased faculty interest and commitment resulted from the combined efforts of LSUSD and CIPECP. Once the CIPECP was established, faculty recruitment and training were expanded to increase faculty awareness about the importance of IPE and its potential benefits. The Teaching Academy again supported IPE training sessions for faculty in its 2015 fall symposium. In addition to these large, somewhat formal experiences, LSUSD faculty members have engaged in other IPE

development/training sessions. Additional LSUSD faculty members volunteered their time to facilitate small group discussions in two large-scale IPE Day sessions held in 2016 and 2017. Each of the IPE Day events included a required faculty training session.

During the 2016-17 academic year, the institution provided several IPE learning opportunities for faculty and students. In September 2016, the CIPECP invited a guest speaker to provide a keynote address to faculty and students. This speaker, an expert in IPE, also participated in a faculty training session on development of IPE clinical cases.

On the LSUSD campus, IPE was a major component of the fall 2016 semiannual Faculty Development Day. The CIPECP director provided an update to the faculty about LSUSD student data, as well as LSUSD faculty and student involvement in IPE (committees, courses, classroom sessions, etc.). Additional formal training has taken place during a semiannual faculty forum attended by all faculty members. Also, through preparation for the dental and dental hygiene 2016 CODA site visit, faculty members were trained about IPE as it related to the accreditation standards. Much effort was devoted to faculty development because previous studies found that developing faculty members to engage in IPE activities aided in IPE integration and sustainability and built capacity to promote collaboration and teamwork in existing curricula.^{6,7}

Methods

This study was approved by the Institutional Review Board at LSUHSC-NO (#9104). All of the LSUHSC-NO students across all four years were invited to participate in a voluntary, anonymous IPE annual student survey in 2015, 2016, and 2017. The survey was slightly modified each year, but consistently measured students' demographics (gender, program, year of study) and their IPE perceptions and included open-ended questions about involvement in IPE experiences. Consent was implied by completing the survey.

To evaluate students' perceptions related to IPE, we sought a standardized, validated instrument as a quantifiable method, targeting Kirkpatrick's level 2a.⁸ The CIPECP chose to use the Student Perceptions of Interprofessional Clinical Education-Revised instrument, version 2 (SPICE-R2) because of its strong psychometric properties for construct validity and reliability.^{9,10} The SPICE-R2 instrument is composed of ten items across three factors (also known as subscales): interprofessional teamwork and team-based practice (four items), roles/responsibilities for collaborative practice (three items), and patient outcomes from collaborative practice (three items) (Table 1). Students rate their level of agreement/disagreement with items using a five-point Likert scale from 1=strongly disagree to 5=strongly agree.

Table 1. Items on Student Perceptions of Interprofessional Clinical Education-Revised instrument, version 2 (SPICE-R2) and their factors

Item	Factor
1. Working with students from different disciplines enhances my education.	Teamwork
2. My role in an interprofessional team is clearly defined.	Roles/Responsibilities
3. Patient/client satisfaction is improved when care is delivered by an interprofessional team.	Patient Outcomes
4. Participating in educational experiences with students from different disciplines enhances my ability to work on an interprofessional team.	Teamwork
5. I have an understanding of the courses taken by, and training requirements of, other health professionals.	Roles/Responsibilities
6. Health care costs are reduced when patients/clients are treated by an interprofessional team.	Patient Outcomes
7. Health professions students from different disciplines should be educated to establish collaborative relationships with one another.	Teamwork
8. I understand the roles of other health professionals in an interprofessional team.	Roles/Responsibilities
9. Patient/client-centeredness increases when care is delivered by an interprofessional team.	Patient Outcomes
10. During their education, health professions students should be involved in teamwork with students from different disciplines in order to understand their respective roles.	Teamwork

The initial validation of the SPICE-R2 at LSUHSC-NO involved 806 students, including 74 from the DDS program. The Cronbach's alpha for overall reliability of the instrument in the LSUHSC-NO population was 0.85 (0.87 for the dental students). Factor-level reliabilities were acceptable to good: teamwork 0.85 (DDS 0.87); roles/responsibilities 0.74 (DDS 0.66); and patient outcomes 0.70 (DDS 0.74).

The four-year LSUSD DDS program accepts 65 students per class. At the beginning of the academic year, LSUSD students were sent a link to the survey via email in August 2015, 2016, and 2017. Three emails (one initial and two reminders) were sent over a period of three weeks to encourage participation. In fall 2017, the first-year dental students were enrolled in a required IPE experience, which included mandatory completion of SPICE-R2.

All quantitative analyses were performed using the Statistical Analysis System (version 9.4). Comparisons were carried out using a one-way ANOVA to determine whether a significant difference ($p < 0.05$) existed between the SPICE-R2 baseline means of first-, second-, third-, and fourth-year dental students across the three years. A Tukey's post-hoc test was used to determine whether statistically significant differences in baseline means existed across the four dental student cohorts (first year, second year, etc.).

Results

In 2015, 259 invitation emails were sent to dental students in all four years, followed by 257 emails in 2016 and 255 emails in 2017. A total of 120 dental students participated in the 2015 survey (46% participation), 160 in the 2016 survey (62% participation), and 170 in the 2017 survey (67% participation). The number of students who completed the SPICE-R2 by academic year and year in program and the baseline means for overall SPICE-R2 instrument scores, as well as factor-specific baseline mean scores, are shown in Table 2.

Initially, we performed a two-way ANOVA with factors for academic year and year in academic program. A significant interaction was found for the total SPICE-R2 mean score and each of the three factors. Therefore, we conducted a series of one-way ANOVAs to determine the relationship between academic year and year in academic program.

We found a statistically significant difference between groups as determined by one-way ANOVA for first-year students on each factor and total SPICE-R2 ($p < 0.01$). A Tukey post-hoc test found the first-year students in 2017 had higher mean scores on the total SPICE-R2, factor 1 (teamwork), factor 2 (roles/responsibilities), and factor 3 (patient outcomes) than the first-year students in 2015. The first-year students in 2017 also had higher mean scores on the

Table 2. Number of participating dental students and their scores by program year in three academic years: by total and on each factor

Program Year	Academic Year (N)	SPICE-R2 Mean (SD)	Factor 1: Teamwork Mean (SD)	Factor 2: Roles Mean (SD)	Factor 3: Patient Outcomes Mean (SD)
1 st year	2015 (30)	37.03 (4.62)	16.16 (2.62)	10.3 (1.96)	10.56 (1.69)
	2016 (27)	38.81 (5.18)	17.07 (2.40)	9.62 (2.23)	12.11 (1.92)
	2017 (65)	42.36 (4.51)	18.03 (2.24)	11.5 (2.17)	12.83 (1.89)
2 nd year	2015 (20)	38.25 (4.72)	16.85 (2.53)	10.0 (2.05)	11.4 (1.63)
	2016 (46)	38.41 (5.18)	16.06 (2.34)	11.02 (1.93)	11.3 (1.88)
	2017 (39)	38.53 (3.74)	16.35 (2.2)	10.05 (2.19)	12.12 (1.64)
3 rd year	2015 (15)	40.53 (6.72)	17.0 (2.67)	11.4 (2.64)	12.13 (2.09)
	2016 (19)	36.57 (6.38)	16.0 (3.12)	9.68 (2.51)	10.89 (2.7)
	2017 (40)	38.75 (6.07)	16.37 (2.74)	10.7 (2.07)	11.67 (2.08)
4 th year	2015 (9)	35.66 (10.66)	15.44 (4.97)	9.0 (3.0)	11.22 (3.59)
	2016 (19)	40.1 (4.6)	17.31 (1.88)	10.94 (1.84)	11.84 (2.36)
	2017 (26)	38.73 (6.63)	16.5 (2.58)	10.42 (2.80)	11.8 (2.53)

SPICE-R2=Student Perceptions of Interprofessional Clinical Education-Revised instrument, version 2

total SPICE-R2, factor 1, and factor 3 than the first-year students in 2016. There were no statistically significant differences between cohort means for the second-, third-, and fourth-year students.

There were no statistically significant differences between student cohort means for the 2015 academic year as determined by one-way ANOVA. However, a statistically significant difference was found in 2016 for the roles/responsibilities factor and in 2017 for the total SPICE-R2 and each of the three factors ($p < 0.05$). In 2016, the second-year students had a statistically significant higher mean score than the first-year students for roles/responsibilities. In 2017, the first-year students had a statistically significant higher mean score on total SPICE-R2 and the teamwork factor than the second-, third-, and fourth-year students. For roles/responsibilities, the first-year students had a statistically significant higher mean score than the second-year students. For the patient outcomes factor, the first-year students had a statistically significant higher mean score than the third-year students.

Discussion

In 2014, 90% of U.S. dental schools reported offering IPE activities for their dental students, and 41 of the schools indicated IPE activities had been initiated in the past five years or less with opportunities in a wide array of settings, such as classroom, clinical, community, and/or laboratory.¹¹ LSUSD would have been one of the 41 programs in the initial stages of IPE development in 2014.

In a recent article, Hamil reported on interviews she conducted with six U.S. dental schools with extensive IPE efforts.¹² All of these schools she assessed demonstrated an institutional commitment to IPE through centralized programming, and their representatives noted that scheduling, time, and funding continued to be the most common barriers—similar to the barriers reported by Formicola et al. in 2012.¹³ In addition to those barriers, LSUSD has another significant barrier. The LSUSD campus is physically separated from the other five LSUHSC-NO schools by a 20-minute car ride. The physical distance has decreased the number of IPE learning activities scheduled that involve the LSUSD programs with programs in the other five schools. The separation of campuses also prohibits interprofessional socialization that Khalili et al. noted can occur on a shared campus.¹⁴

At LSUHSC-NO, administration, faculty, and student commitment to IPE has evolved over the past seven years. Increased faculty support assisted in establishment of an institutional two-year IPE curriculum for all first- and second-year students, known as Team Up: Commit to Compassion, Communication, and Collaboration.¹⁵ In September 2017, all LSUHSC-NO first-year students started their engagement in Team Up. Team Up includes 14 two-hour class sessions, in which 65 student groups utilize large and small classroom spaces on both the dental and downtown campuses. The required IPE curriculum addresses the barriers of scheduling, time, and physical distance.

The main experiential difference between the first-year students in 2017 and the other first-year cohorts was implementation of the mandatory two-year IPE curriculum. It should be noted that no IPE content had been delivered, except for online introductions among student group members, during the timeframe in which the 2017 students completed the survey. However, the students were aware that this curriculum was a two-year team-based interprofessional experience. This knowledge may have created interest in IPE and a sense of its importance. Further research is needed to determine definitively if increased awareness of IPE, even in the absence of IPE engagement, has an impact on students' perceptions of IPE.

Causal relationships between the students' IPE experiences and their SPICE-R2 mean scores cannot be determined based on the analyses used in this study. However, it is important to emphasize the timing of IPE opportunities in relation to timing of the SPICE-R2 over the past three years (Table 3).

No significant differences were found among the second-, third-, or fourth-year student cohorts in the three years studied. Further research is needed to determine effects of IPE activities on student IPE perceptions over a longer period of time. The SPICE-R2 instrument has not been studied for use over longer periods, as utilized in our study. However, IPE experiences in the LSUSD were minimal prior to the fall 2017 semester. Nonsignificant findings across the second-, third-, and fourth-year student cohorts over the three-year period were not unexpected, considering the infrequent IPE opportunities those students had.

Table 3. Dental students' interprofessional education (IPE) in relation to participation in survey

Program Year	2015	2016	2017
1 st year	None	Brief orientation (6 weeks prior to survey)	Orientation to IPE and Team Up (6 weeks prior to survey)
2 nd year	None	2-hour IPE session on genetics with all 6 schools (8 months prior to survey)	2-hour IPE session on immunizations with all 6 schools (8 months prior to survey)
3 rd year	None	None	2-hour IPE session on genetics with all 6 schools (20 months prior to survey)
4 th year	None	None	2-hour IPE session on temporomandibular disorders with physical therapy students (10 months prior to survey)

Team Up=two-year IPE curriculum for all first- and second-year students

Strengths and Weaknesses of Study

Strengths of this study were its inclusion of three years' data and use of a validated outcome measure. We found two research studies in the U.S. evaluating the effects of an IPE curriculum on health professions students' IPE perceptions.^{16,17} In those studies, the instruments used to measure student perceptions were the Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS).

One of those studies engaged first-year dental, pharmacy, nursing, medicine, and physical therapy students in an IPE curriculum and measured their IPE perceptions prior to the intervention and after three years.¹⁶ That study reported data as change in score for all students, not by program. Of the six subscales measured, statistical significance was found for three of the subscales (one RIPLS subscale and two IEPS subscales). The other study assessed first-year medicine, nursing, and physician assistant students and repeated the survey in the students' third year of study, using various comparative analyses such as change in score and age, gender, previous health care experience, IPE courses, and extracurricular IPE experiences.¹⁷ The results showed that participation in extracurricular IPE projects or participation in an IPE student-run clinic had a statistically significant impact on students' subscale scores.

Our study measured IPE scores of dental students on an annual basis over three years. The results showed that, with minimal to no IPE interventions, students' perception scores remained the same regardless of year of study and over a period of three years. Ours is the first research study to track outcomes across a four-year evolving curriculum. These data will also be valuable in comparing these earlier students' IPE perceptions with those students engaged in Team Up.

A limitation of this study is the low (46%) initial student response rate. However, in subsequent years, response rates increased, and since the SPICE-R2 will be part of the mandatory two-year curriculum, we expect future data to be more robust. Another possible limitation is that the SPICE-R2 had not previously been used to track data over subsequent years, but the stable response over time suggested that it should be considered in this type of study. Other limitations of our study include a varied sample size over the three years and within program year, a sample size from a single institution, varied IPE activities, and the lack of data collection prior to graduation.

Moving Forward

Increased faculty support was critical in establishment of the institution-wide, two-year IPE curriculum for all first- and second-year students and was made possible through enhanced faculty development. Through the leadership of CIPECP, the Team Up curriculum addresses the barriers of scheduling, time, and physical distance.

As health professions educational programs incorporate IPE into their curricula, previous studies using perception scales have found both statistically significant positive changes and no change in dental students' perceptions of IPE after being exposed to an IPE learning experience/activity.^{18,19} For LSUHSC-NO and LSUSD, it was foundational to have a baseline understanding of student perceptions regarding collaboration as the institution prepared for both intermittent and extensive IPE experiences. The 2017 baseline data will also assist the university in determining the significance of student learning as required by SACSCOC. The CIPECP will continue to use SPICE-R2 to document changes in students' perceptions with participation in Team Up on an

annual basis. Continuation of SPICE-R2 can strengthen our findings as comparisons are made across LSUSD, LSUHSC-NO schools, LSUHSC-NO programs, and Team Up interprofessional groups.

The LSUSD also has a distinctive opportunity to continue to expand student and faculty interprofessional activities, as well as grow intraprofessional opportunities. The LSUSD has three academic programs (dentistry, dental hygiene, and dental laboratory technology) among which to develop intraprofessional education. The knowledge and skills needed for effective collaboration from an interprofessional or intraprofessional perspective are complimentary.¹³ Therefore, the foundational knowledge gained in year one of the Team Up IPE curriculum can be used as a platform to expand intraprofessional education.

The future of dental education and practice will require collaboration.²⁰ In their assessments of IPE in dental education and the future of health care delivery, Hamil, Formicola et al., and Andrews all promoted the inclusion of intraprofessional and interprofessional learning activities in dental education to improve the quality of care, improve population health measures, and reduce health-related costs.^{12,13,20} The LSUSD is actively working towards developing and refining an integrated and sustainable collaborative curriculum in the classroom and clinical environments.

Even as the focus of IPE research moves beyond student perceptions to measuring other outcomes, it is beneficial to gain an understanding of students' perceptions across their academic journey with various exposures to IPE. At this time, we have found no studies of causal relationships connecting student perceptions, academic training programs, and measured observable collaborative behaviors. Moving forward, the CIPECP will collect paired data in order to strengthen the desired outcomes. Future research incorporating perceptions using the trans-theoretical model for change and/or Kirkpatrick's model for evaluating the effectiveness of training can also advance educational research in IPE.

Conclusion

LSUHSC-NO has taken seven years to build the support and capacity for a sustainable IPE curriculum that engages all first- and second-year students. The development of a centralized office that supports faculty recruitment, faculty training, and IPE activity development has been foundational in

our success. Educating competent students who are fully prepared to maximize patient outcomes through interprofessional patient care is the ultimate goal of IPE and health sciences education. At LSUSD and LSUHSC-NO, this process is under way. Even early in this experience, it has had a significant impact on the student experience, with further improvements anticipated.

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Disclosure

The authors reported no financial, economic, or professional interests that influenced the design, execution, or presentation of this work.

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