Traditional and Interprofessional Curricula for Dental Technology: Perceptions of Students in Two Programs in Australia

Jane L. Evans, B.F.E.T., Ph.D.; Amanda Henderson, B.S.C., M.Sc.S.O.C., Grad.Dip.Nurs. (Educ), Ph.D.; Newell W. Johnson, M.D.Sc., Ph.D., FDSRCS (Eng), FRACDS, FRCPath (UK), FFOP (RCPA), FHEA (UK), FICD

Abstract: Collaboration between dental technicians and other members of the dental care team is essential to achieve optimal outcomes for patients in prosthetic care. Interprofessional education can be effective in improving attitudes, communication, and practices within such teams. This study compared and contrasted the perceptions of role, responsibilities, communication, and teamworking of dental technology students in a traditional curriculum with those in an interprofessional curriculum, both in Australia. A social demographic questionnaire and two standard self-report measures were used to collect data from each year group of the two programs. Thirty to thirty-two of the thirty-nine students enrolled in a traditional dental technology program and nineteen to twenty-two of twenty-five students enrolled in an interprofessional curriculum completed surveys. Statistical analysis of self-report measures identified a significant difference in professional identity, development of roles, and perception of enhanced opportunities for collaboration of dental technologists with the wider oral health professions in those undertaking the interprofessional curriculum. This study suggests that interprofessional learning can shift traditional attitudes and, potentially, improve opportunities for collaboration between dentists and dental technicians. It also supports the idea that adoption of an interprofessional curriculum can significantly enhance communication and teamwork skills essential for readiness in the workplace.

Dr. Evans is Senior Lecturer in Dental Technology, School of Dentistry and Oral Health and a member of the Population and Social Health Research Program, Griffith Health Institute, Griffith University, Australia; Dr. Henderson is ALTC Associate Fellow, ALTC Discipline Scholar (Health), Professor Griffith Health, Griffith University, and Nursing Director (Education), Metro South Health Service District, Queensland, Australia; and Dr. Johnson is Professor of Dental Research, Griffith Health Institute and the Lead for Population Oral Health, Population and Social Health Research Program, Griffith University, Australia. Direct correspondence and requests for reprints to Dr. Jane L. Evans, School of Dentistry and Oral Health, Griffith University, Gold Coast Campus, 4222, Queensland, Australia; j.evans@griffith.edu.au.

Keywords: dental technician, dental technology, allied dental professionals, allied dental education, interprofessional education, interprofessional learning, Australia

Submitted for publication 3/1/12; accepted 7/12/12

Good communication between professionals, respect for each professional's role and contribution, enhanced collaboration, focus on patient care, and preparation for rewarding career progression are important learning goals of dental education.[1,2] These have been posited as key outcomes from interprofessional learning, also known as interprofessional education (IPE).[3-9] As long ago as 1988, the World Health Organization published an authoritative report on the matter titled *Learning Together to Work Together for Health*.[10] This report provided guidance and was widely endorsed.[11] In the United States, there has recently been significant collaboration among health professions education associations, including the American Dental Education Association (ADEA), regarding interprofessional education and practice.[12]

An IPE curriculum is an educational program that provides opportunities for groups of students from different disciplines to learn with, from, and about each other.[3] The intention is to develop awareness of each other's knowledge and skills, to encourage development of respect for individual roles, and to foster collaboration in subsequent professional activities. In education for the health professions, it departs from traditional curricula that ascribe greater value to the completion of the practical tasks in one's own professional role.

The value of enhanced communication, collaboration, and teamwork has been deemed important by professional dental bodies. ADEA, the Association for Dental Education in Europe (ADEE), and the General Dental Council in the United Kingdom stipulate that all dental qualifications need to include competencies relating to teamwork and collaboration with allied oral health professionals (AOHPs).[13-15] Internationally, there have been numerous appeals for collaboration between dentists and dental techni-

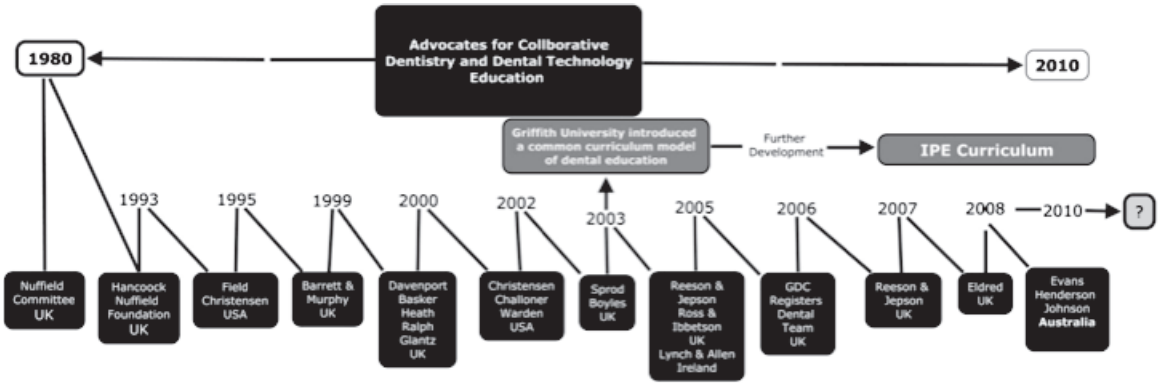

Figure 1. Advocates for collaboration of dentistry and dental technology education

cians since 1980 (Figure 1).[16] Dental education has been said to be at risk of remaining "siloed" and "left behind"[17] if the education of dentists and the various AOHPs remains isolated and fragmented.[18]

While the benefits of IPE activities have been demonstrated in health care teams that consistently work together,[19-21] the value of IPE for students is still relatively unexplored. Further, most studies involving health professions teaching pertain to particular courses rather than evaluation of entire programs or curricula.[6,22,23] Given the value of work-readiness skills, communication, collaboration, and teamwork for optimal patient care, it is important that the strengths and weaknesses of different types of programs be understood. The aim of our study was to compare the attitudes of dental technology students in a traditional curriculum with those in an interprofessional curriculum regarding their concepts of professional identity, knowledge of roles and responsibilities, and willingness to collaborate within the wider oral health care team. Before describing the study and its results, we provide overviews of the traditional and interprofessional curricula for dental technology education.

Traditional and Interprofessional Curricula

Traditional Curriculum

Throughout the world, technical colleges have been the traditional providers of dental technology education. In Australia, dental technology education has historically been delivered in each state of the Commonwealth through the Technical and Further Education (TAFE) sector—mostly in isolation from the education of dentists.[24] Vocationally oriented, competency-based training is provided at Certificate III to Advanced Diploma level: that is, from dental laboratory assistant to clinical dental technician (also known as denturist or prosthetist). The focus is on specific task and skill developments.[25] Traditional education relies on a teacher-centered approach in which the students are required to accept fixed answers and techniques, generally passed from one generation to another.[26]

The traditional curriculum for dental technology in Queensland is of eighteen months' duration and includes one day per week of work experience external to the training establishment. In this curriculum, thirty modules of the national training package are delivered didactically, including underpinning knowledge components such as anatomy and dental materials. Students have dedicated dental technology teachers, tutors, and demonstrators to guide them through the learning process. Assessment is predominantly competency skills-based—that is, students are assessed on their proficiency in specific technical tasks. Students spend most of their time situated behind the bench within the confines of the dental laboratory.

Whilst there are specific courses in this curriculum relating to developing communication and teamwork skills, these are difficult to achieve in such isolated settings and are not easily assessed along

with the technical competencies.[16] The culture in dental technology education has been about producing skills in students, not developing future professionals to work collectively within an oral health care team (OHCT).[2] There is limited focus on developing attitudes, expanding beliefs, or generating creativity to improve the interface with collaborative oral health care delivery.

IPE Curriculum

The IPE curriculum departs significantly from this traditional dental technology training. In 2004, the School of Dentistry and Oral Health at Griffith University (GU) embarked on an IPE approach in the hope of improving communication and collaboration among members of the OHCT.[27] The dental technology curriculum is three years in duration, based within a university, and closely aligned with an independent commercial dental laboratory and a prosthetic clinic owned and operated by the university. The curriculum is designed to empower dental technology students through the teaching of overlapping knowledge and skills with those taught to dental students. There are also opportunities for collaborative learning with other members of the OHCT—specifically, oral health therapy and clinical dental technology students.

Fourteen of the twenty-four courses in the dental technology curriculum include IPE or shared learning.[28] All students enrolled in the first year of the Bachelor of Oral Health in Dental Science, Oral Health Therapy, or Dental Technology are provided with a solid foundation in health and human sciences, communication, and one dental-specific course. The three programs are linked by connecting knowledge to a shared context and building relationships within this team environment. Relationships are encouraged through teamwork activities and assessment, social events, and shared experiences. The second and third years include explicit profession-specific knowledge and practice and collaborative teamwork requirements linked to assessment. Assessment of collaborative learning opportunities includes the degree to which willingness to collaborate is demonstrated by students, pairs, and groups in the form of paired projects, group assignments, group presentations, collaborative research, field studies, and prosthetic cases for patients. Students experience lectures, tutorials, and laboratory sessions with other health professionals, prosthodontists, clinical dental technicians, and dental technicians.

In the GU curriculum, students are required to complete real-life cases in real time, collaborating and interacting in the dental team environment. The dental technology students also conduct a field study, in which they are required to compare workplace practices and the attitudes of professionals to a particular rule or theory they have learned in their three years of study. This activity has provided students with positive collaborative interactions in the dental community, arguably building communities of practice.[29]

The curriculum is structured to successively utilize experiential learning in social settings that build on earlier IPE opportunities.[16] Through these teaching, learning, and assessment strategies, it is anticipated that all students will graduate with increased professional confidence and a willingness to interact with colleagues.[23,30] Our implementation plan is shown in Table 1, with steps other institutions might consider if they wish to take this approach.

Preparing and educating the OHCT to function collaboratively toward a common goal are thought to have the capacity to increase the quantity and quality of oral health service provision. With the benefit of IPE experiences, students graduate with a potentially enhanced level of content and role knowledge, as well as respect and appreciation for their colleagues.[31-33] The intention is that these graduates create change in the OHCTs in terms of communication, collaboration, workforce distribution, skill mix, recruitment and retention, and policy direction. Resolving conflict, fostering mutual respect and support, reducing stress, and improving job satisfaction are some of the outcomes reported from IPE.[3,34-39]

Methods

Ethical clearance had previously been obtained from the Griffith University Human Ethics Research Committee (GU reference number: DOH/10/08/HREC) for the larger project within which this study was situated. With a view to improving the teaching of dental technology in Queensland, reviews of curricula at both the TAFE and Griffith University were undertaken in early 2008. Contributions were made by a number of experienced teachers in several dental disciplines. The present study was designed to generate student input to use in revisions of curriculum content and delivery mode, which might be designed to correct such shortcomings.

Table 1. Ten steps in implementing the IPE dental technology curriculum at Griffith University

1. Originally, a Working Party included academic staff from dentistry, oral health therapy, and dental technology programs at Griffith University, academic staff from the TAFE sector, health professionals from Queensland (Public) Health Departments, private oral health care providers, and professional associations.
   a. Subsequently a smaller Working Party was established to have a focused approach to Dental Technology. Members included the dean of dentistry and oral health at Griffith University, the dental technology program convener, an IPE expert, and the TAFE dental technology lead teacher.
2. Led by the researcher, the Working Party studied current IPE literature and models pertaining to the desired capabilities and competencies for dental technology graduates. The three foci model by Barr et al. was utilized to provide a conceptual framework.
3. The Working Party held brainstorming sessions focused on developing an IPE curriculum with a view to offering knowledge and skills in teamwork, collaboration, and communication and improving attitudes.
4. The management team met with business and resource planning faculty members to fulfill the desired goals and requirements of the university.
5. The researcher engaged with management and accreditation authorities to ensure compliance with predetermined university and regulatory authorities.
6. The Working Party reviewed existing courses in the health faculty of the university to determine suitability or openness to modification.
7. The program convenor planned and developed new courses with IPE and practice opportunities embedded and integrated horizontally and vertically throughout the curriculum so that the IPE experience increases in intensity toward graduation. Consultation with members of the original Working Party was ongoing.
8. The program convenor planned and developed suitable assessment strategies to develop professional identity, encourage IPE collaboration, and develop skills in teamwork.
9. The program convenor and dental technology teaching team cultivated student engagement and development through planned learning and teaching strategies.
10. The program convenor monitored and evaluated progress through continuous evaluation of students, graduates, employers, and academics.

Source for step 2: Barr H, Koppel I, Reeves S, Hammick M, Freeth D. Effective interprofessional education: argument, assumption, and evidence. Oxford: Blackwell, 2005.

Students from each curriculum provided feedback through the following surveys: 1) questionnaire detailing their social demographics, 2) the Readiness for Interprofessional Learning Scale (RIPLS),[40] and 3) the Shared Learning Scale (SLS).[41] The RIPLS and SLS measures were selected because they have been used successfully in other research studies, are relevant to health care, and would be understood by dental technology students whether or not they had exposure to IPE.

Participants in the study were students from the first and second years of the Diploma of Dental Technology at Southbank TAFE (the traditional curriculum) and all three years of the Bachelor of Oral Health in Dental Technology degree program at Griffith University (IPE curriculum). The program leader at each institution explained the study to his or her students at the end of a laboratory session or lecture and encouraged participation. Several weeks later, in mid-2008, an external facilitator distributed all three paper-based questionnaires at the end of a specified laboratory/lecture session in a venue set aside for completing the documents. Use of the external facilitator aimed to limit researcher bias and minimize opportunities for provoked responses.[42,43]

The first questionnaire asked students about their social situation. It included questions on the participant's age, gender, schooling, and previous qualifications. The second questionnaire, the RIPLS,[34] has nineteen questions and measures the strength of beliefs surrounding IPE, using three subscales: teamwork and collaboration (questions 1-9), professional identity (questions 10-16), and roles and responsibilities (questions (17-19). Psychometric evaluations have shown that, for the total scale, the RIPLS has a high internal consistency (Cronbach's alpha=0.9).[40]

The third questionnaire, the SLS,[41] collected students' perceptions and attitudes towards IPE. It consisted of twenty-five items: twenty requiring Likert responses and five open-ended questions. The former related to three subgroups: roles and responsibilities (questions 1, 2, 9, 13, and 16); aspects of learning with students studying other oral health professions, i.e., dentistry and oral health therapy (questions 3, 5, 8, 17, 19, and 20); and teamwork and collaboration (questions 4, 6, 7, 10, 11, 12, 14, 15, and 18). The open-ended questions allowed respondents to clarify their responses, explain their understanding of and perspectives on shared learning, and comment

on the most/least positive aspects of shared learning. Reliability and validity of the subscales were validated by the original authors.[41]

All quantitative data were evaluated using Statistical Package for the Social Sciences (SPSS version 15.0). Descriptive statistics including the mean, standard deviation, median, and range were calculated for each group. Analysis of variance (ANOVA) was used to determine whether significant differences existed in the overall responses, subscales and individual questions. A p-value of ≤ 0.05 was considered statistically significant.

Narrative data from the SLS open-ended questions were coded, analyzed, and then reviewed by a second researcher for verification and to prevent bias.[44] Coding was done with an Excel spreadsheet. The data were then systematically analyzed using a semantic mapping software program, Leximancer.[45,46] This program assists with the organization of analyzing large pieces of textual data, computes concepts and their relative occurrence, and draws associations between concepts.[46]

Results

Of a possible thirty-nine students in the traditional curriculum, thirty (77 percent) completed the demographic questionnaire and RIPLS, and thirty-two (82 percent) completed the SLS. Of a possible twenty-five students in the IPE curriculum, nineteen (76 percent) completed the demographic questionnaire and RIPLS, and twenty-two (88 percent) completed the SLS. Although the sample size is small, the participation rate was high. Respondents from the traditional curriculum consisted of nineteen males and eleven females; those from the IPE curriculum consisted of ten males and nine females. The IPE group members were younger (Table 2). Almost half of the respondents overall (26/49) had already acquired some form of tertiary qualification prior to enrolling in their current program. Eleven of the thirty students in the traditional curriculum had a qualification at certificate level, four of these in the profession of dental assisting. Six of the thirty traditional respondents had a previous diploma, and four held a Bachelor's degree. However, only two of the nineteen (younger) IPE respondents had a previous qualification, both at certificate level. More IPE respondents (14/19) disclosed that they had attended a private secondary school, with the implication that they came from higher socioeconomic backgrounds.

RIPLS Results

Data from the RIPLS for both groups are shown in Figure 2. The overall, combined scores (left point of diamond) were significantly different between the groups: the traditional students (M=3.52, SD=0.427; p=0.002) gave significantly lower ratings than the IPE students (M=3.94, SD=0.472).

Significant differences were also found between each of the subscales. The IPE participants gave more positive responses to the professional identity (right point of diamond: IPE, M=4.04, SD=0.658; traditional, M=2.71, SD=0.612; p=0.011) and teamwork and collaboration subscales (IPE, M=4.40, SD=0.501; traditional, M=3.76, SD=0.514; p=0.000). Both groups were unsure of their roles and responsibilities, but those in the IPE curriculum more so (traditional, M=2.71, SD=0.611; IPE, M=2.33, SD=0.638; p=0.000). Significant differences were found between groups in ten out of nineteen individual statements (Table 3).

SLS Results

Interestingly, more students in both programs responded to this questionnaire than to the others.

Table 2. Comparison of age groups of study participants

Participants	Age Group				
	16-19	20-25	26-30	31-40	41+
Traditional Dental Technology Students	6	8	10	3	3
IPE Dental Technology Students	3	15	1		

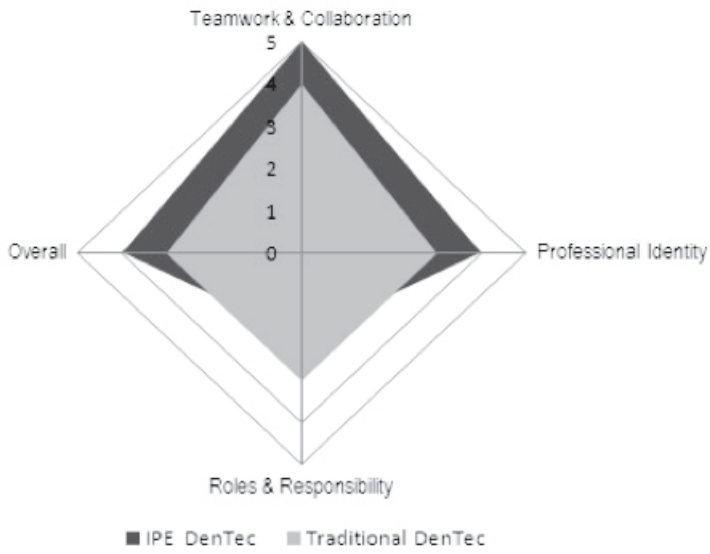

Figure 2. Comparison of RIPLS total and subscale mean scores between groups

There were no significant differences between groups for the overall results or for the three subscales. However, there were differences in response to four questions that relate to collaborative learning (Table 4).

The open-ended questions required participants to provide clarity about their thoughts, including a focus on the most and least positive aspects, with opportunity to add any other comments about shared learning and IPE. The software system Leximancer's Insight Dashboard organized 264 segments and generated thirty concepts from within the two groups. Similar concepts emerged from manual coding. A notable difference was the use of the term "industry" by respondents from the traditional curriculum, whereas others used the term "profession." Students from the interprofessional curriculum rated the following words with the highest relative frequency: "knowledge," "profession," "communication," and "understand." The traditional curriculum respondents had a work and industry focus: words that ranked highly were "work," "students," "learning," and "industry." This group did not talk specifically about respect or mention improved understanding. Ranking concepts by relative frequency, the IPE respondents revealed 52 percent prominence with "patient and dental," "understand and work," and "communication and knowledge." The traditional curriculum respondents displayed a work-orientated focus with 27 percent prominence of "dental and knowledge," "work and dentist," and "work and students."

Respondents from both curricula acknowledged that shared learning is needed in oral health professions education to benefit teamwork in the professions. However, one respondent from the traditional curriculum perceived it to be unnecessary, commenting that "working with oral health care students is unnecessary." Respondents from both curricula had a clear understanding of shared learning. This was described by them as "learning and working together with other oral health care professionals," "gaining common knowledge and skills," "sharing experiences," and a focus on patient care. This was evident through the content analysis (Leximancer) where the term "learning" emerged as a concept with 72 percent more connectivity with workplace learning; the IPE group then further linked this to positive patient care outcomes. However, respondents in the traditional curriculum stated a need for improved learning resources before realistic IPE could be achieved.

The majority of the respondents in both groups commented that the purpose of shared learning was to facilitate/improve communication and cooperation within oral health teams. Indeed, a final-year student from the IPE curriculum suggested communication was the main purpose of IPE: "Shared learning

Table 3. Mean and significance level on RIPLS statements between groups

(1Strongly Disagree - 6 Strongly Agree)

	Statement	IPE Dental Technology $n = 19$	Traditional Dental Technology $n = 30$	p
1	Learning with other dentistry and oral health students would have helped me become a more effective member of an oral health care team	4.53	3.73	.001
2	Patients would ultimately benefit if oral health care students worked together to solve patient problems	4.58	3.6	.000
3	Shared learning with other oral health care students would increase my ability to understand clinical problems	4.42	4.03	.080
4	Learning with oral health care students before qualification would improve relationships after qualification	4.42	3.8	.010
5	Communication skills should be learned with other oral health care students	4.53	3.57	.000
6	Shared learning would have helped me to think positively about other oral health care professionals	4.16	3.57	.018
7	For small group learning to work, students need to trust and respect each other	4.47	4.17	.173
8	Team-working skills are essential for all oral health care students to learn	4.68	3.83	.000
9	Shared learning would help me to understand my own limitations	3.84	3.53	.179
10	I don't want to waste my time learning with other oral health care students	2.82	3.5	.019
11	It is not necessary for undergraduate oral health care students to learn together	3.95	3.13	.004
12	Clinical / Laboratory problem-solving skills can only be learned with students from my own dental technology section	3.74	3.5	.434
13	Shared learning with other oral health care students would help me to communicate better with patients and other professionals	4.31	3.8	.011
14	I would welcome the opportunity to work on small group projects with other oral health care students	3.63	3.53	.724
15	Shared learning would have helped to clarify the nature of patient problems	4.16	3.73	.050
16	Shared learning before qualification will help me become a better team worker	4.26	3.69	.016
17	The function of technicians and therapists is mainly to provide support for dentists	2.05	2.73	.034
18	I'm not sure what my professional role will be	2.16	2.43	.274
19	I have to acquire much more knowledge and skills than other oral health care students	2.79	2.97	.482

means learning and associating with other students to better understand cases/patients and to try and achieve a common goal. Its purpose is to facilitate communication."

Furthermore, the respondents from the IPE curriculum commented that they thought IPE would lead to improved understanding of, and develop respect between, oral health care professionals (OHCPs). That in turn develops confidence in each profession. The IPE respondents indicated they had learned to work collaboratively for professional practice and thought it would ultimately improve patient care. They also thought this would improve students' understanding of the particular challenges of both clinical and laboratory work. The traditional curriculum group focused on their own benefits of gaining more skills rather than developing relationships with other OHCPs (Figure 3). One first-year student in the traditional curriculum noted that IPE would deliver improved work quality: "A broader

Table 4. Mean and significance level on SLS statements between groups

(1 Strongly Agree - 5 Strongly Disagree)

	Statement	IPE Dental Technology $n = 22$	Traditional Dental Technology $n = 32$	p
1	It is important to learn about the roles/responsibilities of other oral healthcare professionals in patient oral health care.	1.73	1.93	.290
2	The best way to learn about the roles/responsibilities of other oral healthcare professionals is by learning with them.	2	2.16	.543
3	Learning with other oral healthcare professionals is unnecessary before qualification.	2	2.91	.001
4	Good teamwork has a positive impact on patient care.	1.45	1.6	.256
5	Learning with other oral healthcare professionals should only occur where there is direct application to dental and laboratory practice.	2.95	2.66	.237
6	I do not need to discuss patient cases with other oral healthcare professionals.	1.95	2.28	.192
7	I feel confident about approaching another oral healthcare professional to discuss patient cases.	2.5	2.38	.595
8	Learning with other oral healthcare professionals will help me to better understand clinical problems.	1.77	2.1	.124
9	I have discussed my professional roles and responsibilities with other oral healthcare professionals.	2.5	2.84	.201
10	In practice, dentists and dental technologists have good working relationships.	2.82	2.66	.500
11	In the dental laboratory, technologists regularly consult all oral health staff about patient issues.	2.91	2.66	.297
12	In the dental laboratory, oral health staff regularly consult all other oral health staff about patient issues.	2.77	2.75	.924
13	My own observation has enabled me to learn as much as I need to know about the roles and responsibilities of other oral healthcare professionals.	3	2.84	.576
14	I have worked collaboratively with a student from another oral healthcare profession.	2.59	3.09	.086
15	Team working skills should be learned only after qualification.	4.18	3.84	.198
16	The function of dental technologists is mainly to provide support for dentists.	3.59	3.38	.507
17	Learning with other healthcare professionals will help me to become a better team worker.	1.77	2.28	.031
18	I would expect dentists to act as leaders in oral healthcare teams.	3.45	2.88	.036
19	Learning with other oral healthcare professionals will help to improve my communication with patients and colleagues.	1.82	2.37	.007
20	I prefer to learn subjects such as anatomy and other science-based topics with students from my own profession.	2.95	2.53	.190

knowledge of all areas will give scope to all sections of dental technology and deliver a higher quality of work." This opinion was consistent with sentiments expressed by others.

The traditional curriculum respondents recorded fewer negative comments than the IPE curriculum respondents (Figure 4). However, both groups expressed concern that IPE may introduce unnecessary content. The IPE group noted concern about hierarchical relationships and the existence of an "inferiority between dentist and dental technology professions," as one respondent put it, while a student in the traditional curriculum commented that IPE learning would "not [allow] enough focus on individual learning that is specific to each dental profession group."

Some respondents from the IPE curriculum stated that shared learning needs to be based around

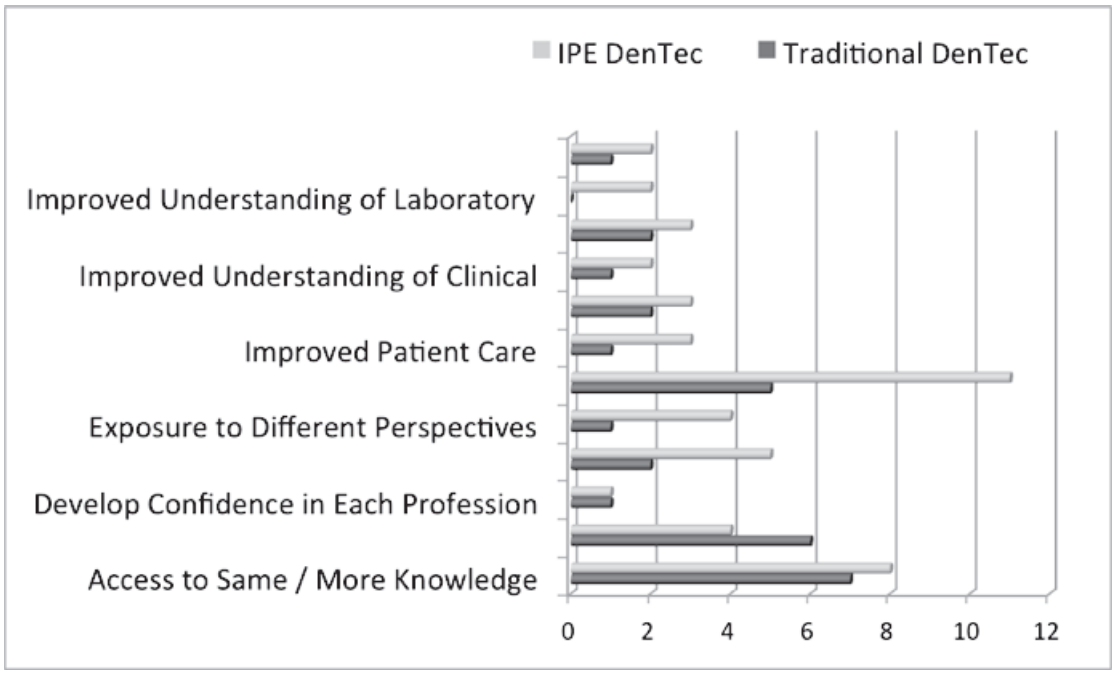

Figure 3. Comparison of number of positive comments between groups

workplace learning and suggested that dental care teams be established early in the program of study in order for students to follow real patient cases and thus learn from and about each others' profession. One IPE second-year student commented, "We should be working in teams with dental students to provide treatment for real patients in an effort to build a strong appreciation of each other's strengths and limitations for a better understanding of each profession." Several respondents from the traditional curriculum expressed their discomfort with their level of skill on graduation, as the following quote from a final-year student exemplifies: "When I have finished this course, I feel that I won't have gained enough knowledge to be a good dental technician simply because of how this course is run and how we are rushed through without much understanding; this worries and frustrates me."

Discussion

The participants in this study differed in age and educational background between the groups but were all preparing to become practicing dental technicians. Whilst the numbers are small, they feed into a modest pool of practitioners in Queensland, totalling approximately 1,000 at present. Data on ethnicity were not collected because it was thought unlikely to be helpful, given the diversity of the Queensland population.

Both curricula have teamwork as a common component, but it is clear that not all students believe they have experienced it. There was a common belief between the two groups that IPE is important, but the extent of belief differed between the groups. This research has clearly shown significant differences regarding professional identity and the strengths and limitations ascribed to IPE.

Compared to the students in the traditional curriculum, the IPE curriculum respondents placed an emphasis on the need to train dentists and dental technicians together. Similar to the results of studies by Cannavina et al.[6] and Reeson and Jepson,[23] the IPE students in our study agreed that shared learning promoted mutual understanding of the roles each oral health professional can play and facilitated improved communication and interpersonal relations within the work setting. Students in the traditional curriculum were less inclined to identify themselves

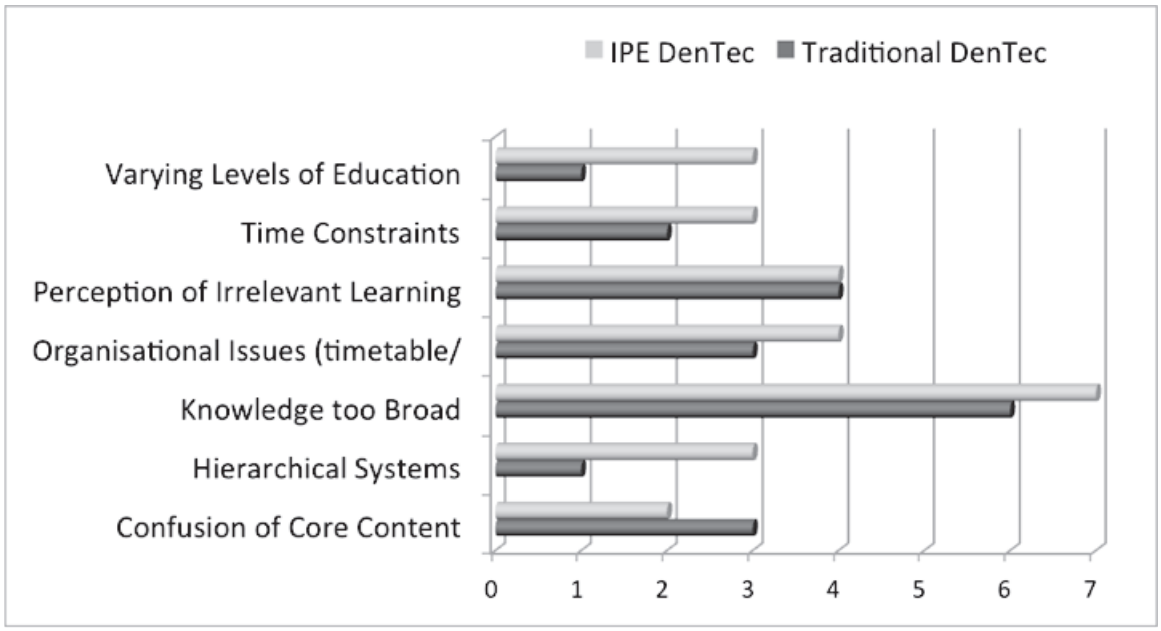

Figure 4. Comparison of number of negative comments between groups

as part of an oral health care team of professionals (RIPLS, professional subscale). They simply aligned themselves with dental technology as "independent" or a single group. Responses from these students indicated that they have limited contact with other oral health practitioners. Furthermore, they were reluctant to engage in the oral health care team. This group also reported not feeling part of or confident within their own profession. On the other hand, the IPE respondents said they believe they are integral members of the team contributing to patient care.

The IPE curriculum students stated that they need more interaction with dental students and with patients to enhance their learning of collaborative prosthetic skills, whereas the students from the traditional curriculum simply preferred increased and isolated prosthetic/technical skill development and said they believed that improved technical skills would enhance the way they are perceived in the workplace. However, learning technical skills in isolation continues to segregate the professions rather than building cooperative links between them.[2] Furthermore, a narrow focus does not value the human interactions involved and contributes to the members of oral health care teams continuing to operate in silos.

The IPE respondents in our study reported a pragmatically strong sense of the importance of the technician-dentist relationship—for example, in generating dentists as clients when they are in the workplace. They also reported a broader sense that IPE is a precursor to forming valuable relationships for their future practice. They noted that IPE gives them the opportunity to build friendships with dentists, to be seen as a colleague, and even sometimes to know which dentists to avoid in practice. The opportunity to build friendships can break down traditional hierarchies.

Consistent with the findings of Morrison and Jenkins,[41] our study found that those students who had not experienced IPE or shared learning tended to have a narrower perspective and a less questioning nature. Indeed, the IPE curriculum is designed to cultivate self-awareness and understanding of others. Another factor might relate to educational background since academic entry requirements differ significantly for each program. Nonetheless, both groups were clearly committed to become dental technicians—whether they viewed their job as a member of the oral health care team or practicing in isolation.

Conclusions and Future Directions

In our study, dental technology students from the traditional curriculum appeared to have a basic working knowledge of shared learning but, in the absence of IPE, they did not understand the nuances of how collaboration can contribute to professional identity. Further, these respondents had less of a sense of belonging to the oral health care team than their counterparts from the IPE curriculum. Respondents from the traditional curriculum showed a distinct lack of professional identity and experienced isolation in the work setting. Although the IPE respondents acknowledged that IPE was occurring throughout their curriculum, they believed it could be improved through further development of clinical teams. It should be noted, however, that a larger sample size is needed to strengthen the significance of these findings.

This research led to a stakeholder meeting, redevelopment of the IPE curriculum at Griffith University, and the formulation of recommendations for creating opportunities for IPE within other schools' dental technology curricula. Further research is planned across a broader range and larger number of students and graduates, including surveying the student bodies both before and after major curriculum changes. We recommend that in future studies like ours a psychological preference measure be used to determine the baseline personalities of participants. Longitudinal studies should also be designed to follow attitudes and behavior of graduates into the workplace.

Acknowledgments

We are grateful to all the students who contributed to this study and to Mr. Trevor Cook and colleagues from the traditional (TAFE) dental technology program who encouraged and assisted in this research. We also thank Mr. John Mackay, who introduced dental technology education to the university sector in Queensland, Australia.

REFERENCES

1. Christensen GJ, Yancey W. Dental laboratory technology in crisis, part II: potential solutions to the challenges facing the industry. J Am Dent Assoc 2005;136:783-6.
2. McGarry TJ, Jacobsen TE. The professions of dentistry and dental laboratory technology: improving the interface. J Am Dent Assoc 2004;135:220-6.
3. Barr H, Koppel I, Reeves S, Hammick M, Freeth D. Effective interprofessional education: argument, assumption, and evidence. Oxford: Blackwell, 2005.
4. Barr H. Piloting interprofessional education: four English case studies, 2007. At: www.health.heacademy.ac.uk/publications/occassionalpaper/OP8.pdf%3E. Accessed: January 23, 2008.
5. Bronstein LR. A model for interdisciplinary collaboration. Soc Work 2003;48:297-306.
6. Cannavina G, Wood D, Winstanley RB, Walsh TF. A retrospective study of shared learning on the BMedSci Dental Technology course at the University of Sheffield. Eur J Dent Educ 2000;4:160-4.
7. Centre for the Advancement of Interprofessional Education. Defining IPE, 2002. At: www.caipe.org.uk/about-us/defining-ipe/. Accessed: February 17, 2008.
8. Freeth D, Hammick M, Koppel I, Reeves S, Barr H. A critical review of evaluations of interprofessional education. London: Centre for the Advancement of Interprofessional Education, 2002.
9. Nisbet G, Henry GD, Ross G, Field MJ. Interprofessional learning for pre-qualification health care students: an outcome-based evaluation. J Interprof Care 2008;22:57-68.
10. World Health Organization. Learning together to work together for health. WHO Technical Report Series 769, 1988. At: http://whqlibdoc.who.int/trs/WHO_TRS_769.pdf. Accessed: February 20, 2012.
11. Meads G, Ashcroft J, Barr H, Scott R, Wild A. The case for interprofessional collaboration. UK Centre for the Advancement of Interprofessional Education. Oxford: Blackwell, 2005.
12. Association of American Medical Colleges. Six leading health education associations unit to form a new organization focused on interprofessional education and practice. At: www.aamc.org/newsroom/newsreleases/273754/120214.html. Accessed: February 20, 2012.
13. Cowpe J, Plasschaert A, Harzer W, Vinkka-Puhakka H, Walmsley AD. Profile and competences for the graduating European dentist, update 2009. Eur J Dent Educ 2010;14:193-202.
14. PCD Curricula Overview Group. Developing the dental team: curricular frameworks for registrable qualifications for professionals complementary to dentistry (PCDs). London: General Dental Council, 2004.
15. Haden NK, Andrieu SC, Chadwick DG, Chmar JE, Cole JR, George MC, et al. The dental education environment. J Dent Educ 2006;70(12):1265-70.
16. Evans JL. An evaluation of interprofessional education in the teaching of dental technology. Ph.D. disssertation, Griffith University, 2010.
17. Wilder RS, O'Donnell JA, Barry JM, Galli DM, Hakim FF, Holyfield LJ, Robbins MR. Is dentistry at risk? A case for interprofessional education. J Dent Educ 2008;72(11):1231-7.
18. Nuffield Foundation. Education and training of personnel auxiliary to dentistry. Norwich, UK: Nuffield Foundation, 1993.
19. McPherson K, Headrick L, Moss F. Working and learning together: good quality care depends on it, but how can we achieve it? Qual Health Care 2001;10:46-53.

20. Wahlstrom O, Sanden I, Hammar M. Multiprofessional education in the medical curriculum. Med Educ 1997;31:425-9.
21. Guest C, Smith L, Bradshaw M, Hardcastle W. Facilitating interprofessional learning for medical and nursing students in clinical practice. Learn Health Social Care 2002;1:132-8.
22. Hammick M, Freeth D, Koppel I, Reeve S, Barr H. A best evidence systematic review of interprofessional education: BEME guide no. 9. Med Teach 2007;29:735-51.
23. Reeson MG, Jepson NJA. Bridging the gap: should the training of dental technicians be linked with that of the dental undergraduate? Br Dent J 2005;198:642-5.
24. Department of Education Employment and Workplace Relations. HLT50507-diploma of dental technology, HLT07-health training package, 2009. At: http://training.gov.au/Training/Details/HLT50507%3E. Accessed: October 30, 2011.
25. Gonczi A. Competency-based assessment in the professions in Australia. Assessment Educ 1994;1:27-44.
26. Dewey J. Experience and education. New York: Macmillan, 1963.
27. Evans JL, Henderson AJ, Johnson NW. The future of education and training in dental technology: designing a dental curriculum that facilitates teamwork across the oral health professions. Br Dent J 2010;208:227-30.
28. Evans JL, Henderson AJ, Johnson NW. Interprofessional learning enhances knowledge of roles but is less able to shift attitudes: a case study from dental education. Eur J Dent Educ 2012;10.
29. Wenger E, Dermott RM, Snyder WM. Cultivating communities of practice: a guide to managing knowledge. Boston: Harvard Business School, 2002.
30. McNair RP. The case for educating health care students in professionalism as the core content of interprofessional education. Med Educ 2005;39:456-64.
31. Leaviss J. Exploring the perceived effect of an undergraduate multiprofessional educational intervention. Med Educ 2000;34:483-6.
32. Hind M, Norman I, Copper S, et al. Interprofessional perceptions of health care students. J Interprof Care 2003;17:21-34.
33. Oandasan I, Reeves S. Key elements for interprofessional education, part 1: the learner, the educator, and the learning context. J Interprof Care 2005;19:21-38.
34. Luecht RM, Madsen MK, Taugher MP, Pettersen BJ. Assessing professional perceptions: design and validation of an interdisciplinary education perception scale. J Allied Health 1990;19:181-91.
35. McNair R, Stone N, Sims J, Curtis C. Australian evidence for interprofessional education contributing to effective teamwork preparation and interest in rural practice. J Interprof Care 2005;19:579-94.
36. Morison S, Booham M, Jenkins J, Moutray M. Facilitating undergraduate interprofessional learning in health care: comparing classroom and clinical learning for nursing and medical students. Learn Health Soc Care 2003;2:92-104.
37. Morison S, Marley J, Stevenson M, Milner S. Preparing for the dental team: investigating the views of dental and dental care professional students. Eur J Dent Educ 2008;12:23-8.
38. Poulton BC, West MA. The determinants of effectiveness in primary health care teams. J Interprof Care 1999;13: 7-18.
39. Tope R. Integrated interdisciplinary learning between the health and social care professions: a feasibility study. Avebury, UK: Aldershot, 1996.
40. Parsell G, Bligh J. The development of a questionnaire to assess the readiness of health care students for interprofessional learning (RIPLS). Med Educ 1999;33:95-100.
41. Morrison S, Jenkins J. Sustained effects of interprofessional learning on student attitudes to communication and teamworking depend on shared learning opportunities on clinical placement as well as in the classroom. Med Teach 2007;29:450-6.
42. Marshall C, Rossman GB. Designing qualitative research. 3rd ed. Thousand Oaks, CA: Sage, 1999.
43. Babbie E. The practice of social research. 11th ed. Belmont, CA: Wadsworth, 2007.
44. Liamputtong P, Ezzy D. Qualitative research methods. 2nd ed. Melbourne: Oxford University Press, 2005.
45. Smith AE, Humphreys MS. Evaluation of unsupervised semantic mapping of natural language with Leximancer. Behav Res Methods 2006;38:262-79.
46. Smith AE. Automatic extraction of semantic networks from text using Leximancer. Presentation at HLT-NAACL 2003 Human Language Technology Conference, North American Chapter of the Association for Computational Linguistics, 2003.