Taylor & Francis
Taylor & Francis Group

Journal of Interprofessional Care

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/ijic20

Dissecting through the decade: a 10-year cross-sectional analysis of interprofessional experiences in the anatomy lab

Shirley Quach, Sakshi Sinha, Alexandra Todd, Andrew Palombella, Jasmine Rockarts, Sarah Wojkowski, Bruce Wainman & Yasmeen Mezil

To cite this article: Shirley Quach, Sakshi Sinha, Alexandra Todd, Andrew Palombella, Jasmine Rockarts, Sarah Wojkowski, Bruce Wainman & Yasmeen Mezil (2024) Dissecting through the decade: a 10-year cross-sectional analysis of interprofessional experiences in the anatomy lab, Journal of Interprofessional Care, 38:5, 836-845, DOI: 10.1080/13561820.2024.2343828

To link to this article: https://doi.org/10.1080/13561820.2024.2343828

JOURNAL OF INTERPROFESSIONAL CARE
2024, VOL. 38, NO. 5, 836–845
https://doi.org/10.1080/13561820.2024.2343828

Dissecting through the decade: a 10-year cross-sectional analysis of interprofessional experiences in the anatomy lab

Shirley Quach[a,b], Sakshi Sinha[c], Alexandra Todd[c], Andrew Palombella[c], Jasmine Rockarts[c], Sarah Wojkowski[a,b], Bruce Wainman[c,d], and Yasmeen Mezil[c,d]

[a]Program for Interprofessional Practice, Education and Research, McMaster University, Hamilton, Canada; [b]School of Rehabilitation Sciences, McMaster University, Hamilton, Canada; [c]Education Program in Anatomy, McMaster University, Hamilton, Canada; [d]Department of Pathology and Molecular Medicine, McMaster University, Hamilton, Canada

ABSTRACT

Interprofessional education (IPE) is prioritized as a critical component in preparing pre-licensure health professional students for effective teamwork and collaboration in the workplace to facilitate patient-centered care. Knowledge in anatomy is fundamental for healthcare professionals, making interprofessional anatomy education an attractive intervention for IPE and anatomy learning. Since 2009, the Education Program in Anatomy at McMaster University has offered an intensive 10-week IPE Anatomy Dissection elective to seven health professional programs annually. From 2011, students were invited to complete the Readiness for Interprofessional Scale (RIPLS) and Interprofessional Education Perception Scale (IEPS) before and after the elective. A total of 264 students from 2011 to 2020 completed RIPLS and IEPS. There were significant differences before and after the elective in students' total RIPLS scores and three of the four subscales: teamwork and collaboration, positive professional identity, and roles and responsibilities. Similarly, there were statistical differences in the total IEPS scores and two of three subscales: competency and autonomy and perceived actual cooperation. Statistically significant differences in RIPLS and IEPS total scores across several disciplines were also observed. This study demonstrates the elective's impact in improving students' IPE perceptions and attitudes, likely from the extended learning and exposure opportunity with other disciplines.

ARTICLE HISTORY
Received 11 September 2023
Revised 7 February 2024
Accepted 9 April 2024

KEYWORDS
Anatomy; health sciences; interdisciplinary education; interprofessional education

Introduction

Current healthcare systems continue to struggle to meet the complex healthcare needs of patients, proving it is a priority for the future health workforce to address (World Health Organization, 2010). The World Health Organization (WHO) *Framework for Action on Interprofessional Education and Collaborative Practice* (World Health Organization, 2010) outlined the potential of effective interprofessional collaborations to support patient management and optimize healthcare resources without jeopardizing quality of care (Canadian Interprofessional Health Collaborative, 2010). The responsibility of delivering high-quality care is not reserved for a single profession but is the cumulative effort across different disciplines with unique skill sets (Hamilton et al., 2008; Judge et al., 2015). This necessitates the integration of interprofessional learning opportunities for future healthcare workers to develop collaborative skills to be prepared for the workforce (Azzam et al., 2022; Herrmann et al., 2015; World Health Organization, 2010).

Interprofessional education (IPE) is identified as a priority and is readily integrated into competency profiles across multiple health disciplines to ensure collaborative and communicative skills are practiced pre-licensure. IPE is defined when two or more disciplines learn together to develop the knowledge and skills required to effectively collaborate and improve health outcomes (Herrmann et al., 2015; Homeyer et al., 2018). IPE training can improve students' knowledge, skills, and attitudes toward interprofessional collaboration (Al-Qahtani, 2016; Cameron et al., 2009; Judge et al., 2015; King et al., 2012), enhancing their working relationships between healthcare professionals by minimizing professional misunderstanding and protectionism (González Blum et al., 2022; Guraya & Barr, 2018; Herrmann et al., 2015). Knowledge in anatomy and physiology is fundamental to health professionals, regardless of their different roles, competencies, and skillsets (González Blum et al., 2022; Meyer et al., 2017). Given the universal importance across healthcare professionals, anatomy education offers an ideal platform for IPE activities for anatomical concepts to be revisited and applied (Herrmann et al., 2015). Furthermore, the collective nature of IPE activities as seen in group discussions, team-based dissections, and peer-led presentations, also facilitates a proactive learning environment that is built on peer-assisted learning. Peer-assisted learning is when students learn from their peers (Shenoy & Petersen, 2020). In anatomy education, peer-assisted learning has been proven to be advantageous in influencing student's perceptions and knowledge acquisition, improving teaching and communication skills,

CONTACT Shirley Quach quachi1@mcmaster.ca Program for Interprofessional Practice, Education and Research, Faculty of Health Sciences, McMaster University, Hamilton L8S 1C7, Canada
Supplemental data for this article can be accessed online at https://doi.org/10.1080/13561820.2024.2343828

and creating a safe learning environment for students and tutors (De Louche et al., 2023; Shenoy & Petersen, 2020). Therefore, interprofessional anatomy education has been used to support IPE, as it has a common goal of supporting all students with their anatomical education to support future clinical work, while also encouraging students from different professions to learn from and with one another (Herrmann et al., 2015; Meyer et al., 2017; Sytsma et al., 2015). Anatomy focused IPE can also lead to students' improved appreciation of the human body, their professional identities, and increased awareness of each other's skill sets to facilitate problem-solving and patient-centered approaches (González Blum et al., 2022; Homeyer et al., 2018).

Since 2009, the Education Program in Anatomy at McMaster University facilitates an annual 10-week IPE Anatomy Dissection elective for students from undergraduate (midwifery [MW], nursing [RN], physician assistant [PA], and medicine [MD]), and graduate (physiotherapy [PT], occupational therapy [OT], speech-language pathology [SLP]) health professional programs. This annual elective restricts the number of students who can enroll from each discipline to ensure interprofessional composition. Past evaluations of students' attitudes before and after the elective demonstrated effectiveness at improving students' professional identity, anatomy competency, and willingness to collaborate with other students from two up to four disciplines (González Blum et al., 2022; Hamilton et al., 2008; Herrmann et al., 2015; Judge et al., 2015; Meyer et al., 2017; Sytsma et al., 2015). However, there are limitations to the general applicability of past results as electives evolve from annual refinements and student cohorts vary year to year. There is currently a lack of research comparing the changes in students' perceptions toward IPE across multiple years and disciplines. The IPE Anatomy Dissection elective at McMaster University has been running for approximately 15 years, and has been evaluated in at least four publications (Fernandes et al., 2015; Mackinnon et al., 2022; Oliveira et al., 2023; Zheng et al., 2019). This elective continues to be offered to students in seven different programs in health sciences. Therefore, this collection of students' changes in attitudes and perceptions provides an extensive evaluation of the interprofessional anatomy elective across multiple disciplines and years, respectively.

Objectives

The objective of this work is to investigate the effect of IPE readiness for interprofessional development of students in the Faculty of Health Sciences (FHS) who participated in the IPE Anatomy Dissection elective across disciplines as reported by the Readiness for Interprofessional Scale (RIPLS) and Interprofessional Education Perception Scale (IEPS).

Methods

Study design

This was a prospective, cross-sectional program evaluation of the effectiveness of the Interprofessional Anatomy Dissection elective in preparing students for IPE readiness. This study has received ethics approval from Hamilton integrated Research Ethics Board (10–540).

Elective and participants

Students enrolled in the seven health professional programs at the Faculty of Health Sciences, McMaster University, are required to engage in interprofessional learning as part of their degree requirements. To support the provision and availability of IPE experiences, the Faculty of Health Sciences, McMaster University have established a central program, the Program for Interprofessional Practice, Education, and Research (PIPER), which works collaboratively with faculty members, student groups, and others within the university to develop or endorse a variety of elective workshops and seminars primarily over the academic year (September – August). The IPE activities are rated at different levels: exposure, immersion, and mastery – according to the length of time and expected student involvement in each experience. The IPE Anatomy Dissection elective has historically been one of the few mastery level IPE experiences available. This interprofessional, gross anatomy dissection elective was created in 2009 and runs annually from January to early March. The elective runs weekly for 3-hours each session, where students deliver presentations on scope of practice and anatomy, discuss clinical case studies, and collectively perform cadaveric dissections with their peers. Students are assigned into interprofessional groups to complete the cadaveric dissections in the latter half of the session, guided by facilitators with previous anatomy knowledge and elective experience. Presentations, case studies, and group-based dissection were designed on the premise of multiple pedagogical approaches including peer-assisted learning (De Louche et al., 2023; Shenoy & Petersen, 2020), case-based, interactive learning (Singh et al., 2019), and problem-based learning (Trullàs et al., 2022). For detailed curriculum outline of the IPE Anatomy Dissection elective, please see the Supplementary Materials. Additionally, a detailed description of this elective has been published previously by Fernandes et al. (2015) and Zheng et al. (2019). This elective is limited to approximately 28 to 32 students yearly, with registration open to first year students from multiple health programs, including MW, RN, PA, MD, PT, and OT. Additionally, as of 2018, the elective was made available to students from the SLP program which began in fall 2017. The number of participants from each discipline is limited to ensure multidisciplinary representation for the purposes of the elective.

Data collection and surveys

As an ongoing effort to improve the content and delivery of the IPE Anatomy Dissection elective, students' IPE experiences and feedback were collected. Specifically, students' perceptions and attitudes toward IPE before and after participating in the elective were collected from 2011 to 2020. The students' program of study was the only collected demographic characteristic. Students were instructed to create codenames to help with pairing their pre- and post-elective survey responses for future analyses. Students were invited to complete two IPE

perception scales: Readiness for Interprofessional Learning Scale (RIPLS) (McFadyen et al., 2005) and Interprofessional Education Perception scale (IEPS) (McFadyen et al., 2007). Hardcopies of the surveys were provided to students between 2011 and 2018 before transitioning to online forms in 2019. Pre-elective surveys were distributed to students in week one, before they engaged in interdisciplinary group learning and cadaveric dissections. After elective completion, students were re-invited to complete the post-elective surveys within two weeks of their last interactions with their peers. Survey responses were manually entered and stored onto an Excel spreadsheet.

Readiness for Interprofessional Learning Scale (RIPLS)

The RIPLS is a self-assessment questionnaire created by Parsell and Bligh in 1999 (Parsell & Bligh, 1999), and later modified by McFayden et al. in 2005 (McFadyen et al., 2005), commonly used to evaluate students' knowledge, perceptions, and readiness for interprofessional learning. RIPLS measures IPE readiness using 19 statements across four subscales: 1) Teamwork and collaboration; 2) Negative Professional Identity; 3) Positive Professional Identity; and 4) Roles and Responsibilities. Each statement is ranked using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). Rankings for each statement are tallied under each subscale and cumulatively across all four to obtain the total score ranging from 19 to 95, with higher scores reflective of greater IPE readiness. The total median score of 47.5 is reported to be used as the threshold to indicate students' readiness (Al-Qahtani, 2016). RIPLS has been validated in several different health disciplines across various studies (King et al., 2012; Rajiah et al., 2016), with reported Cronbach's alpha of 0.84 to 0.89 for the total scale (McFadyen et al., 2005; Sciascia et al., 2021). Previous reports have outlined RIPLS in greater detail (Al-Qahtani, 2016; King et al., 2012).

Interdisciplinary Education Perception Scale (IEPS)

The IEPS is a 12-item, self-assessment questionnaire described by McFadyen et al. (2007) and is used to assess students' perceptions and attitudes for interprofessional collaboration across three subscales: 1) Competency & Autonomy; 2) Perceived Need for Cooperation; and 3) Perception of Actual Cooperation (Cameron et al., 2009; McFadyen et al., 2007). Each item is ranked using a 6-point Likert scale, with 1 for strongly disagree and 6 for strongly agree. Total IEPS score ranges from 12 (low) to 72 (high) for positive perception and attitudes, respectively. IEPS is another commonly used scale for measuring IPE attitudes and perceptions across health disciplines (Rajiah et al., 2016; Sciascia et al., 2021). IEPS appears to be a reliable and internally consistent tool, with a Cronbach's alpha of 0.84–0.86 for the total scale and fair to moderate test–retest Kappa values (McFadyen et al., 2007).

Data analysis

Central tendencies, descriptive statistics, including counts and frequencies were reported. Baseline and end of elective RIPLS and IEPS total and subscale scores were analyzed with paired t-tests and subgroup analyzes using analysis of variance (ANOVA). Mean RIPLS and IEPS scores with their standard deviations were reported. All data were run in STATA B/E 17.0 and p-value ≤.05 was considered statistically significant.

Results

Participants

A total of 264 students completed the gross anatomy dissection elective from 2011 to 2020. Medical students comprised of 31% of the total participants, while there was relatively similar distribution across the other disciplines (11–14%), apart from SLP (0.7–1.0%). Table 1 details a breakdown of professional students across disciplines over the years.

RIPLS and IEPS total and subscale scores for all disciplines

Figure 1 presents the mean total scores for RIPLS and IEPS at the beginning (pre) and end (post) of the elective. There were statistically significant differences between the pre and post mean total scores (mean± standard deviation) for RIPLS (76.6 ± 6.32 vs 78.7 ± 5.95, $p < .001$) and IEPS (62.2 ± 5.86 vs 64.0 ± 5.79, $p < .001$), respectively. Numerical data for the mean total RIPLS and IEPS scores are available in supplementary material (Table S1).

Figure 2 presents the mean subscale scores for RIPLS and IEPS at the beginning (pre) and end (post) of the elective. Significant pre- and post-elective mean differences were observed in three of the four RIPLS subscale scores, specifically: Teamwork and Collaboration (41.08 ± 3.37 vs 42.03 ± 3.25, $p < .001$); Positive Professional Identity (15.16 ± 2.20 vs 15.51 ± 1.97, $p < .01$); and Roles and Responsibilities (6.99 ± 1.54 vs 7.56 ± 1.56, $p < .01$). There were also significant mean differences in two IEPS subscale scores: Competency and Autonomy (25.77 ± 2.72 vs 26.35 ± 2.76, $p < .01$) and

Table 1. Distribution of FHS students in the IPE Anatomy Dissection elective between 2011 and 2020.

Discipline	Count	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
MD	83	9	7	4	7	9	8	11	9	9	10
MW	35	2	3	3	3	4	3	4	5	4	4
OT	35	3	4	3	4	4	3	3	5	3	4
PA	36	2	5	4	4	4	4	4	5	1	3
PT	30	4	2	3	4	4	3	1	4	1	4
RN	38	5	4	4	4	2	3	4	3	4	5
SLP*	7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	3	2	2
Total	264	25	25	21	26	27	24	27	34	23	32

Abbreviations: MD, Medicine; MW, Midwifery; OT, Occupational Therapy; PA, Physician Assistant; PT, Physiotherapy; RN, Registered Nursing; SLP, Speech Language Pathology. *SLP was introduced into the School of Rehabilitation Science in 2017 and the first students enrolled into the elective in 2018.

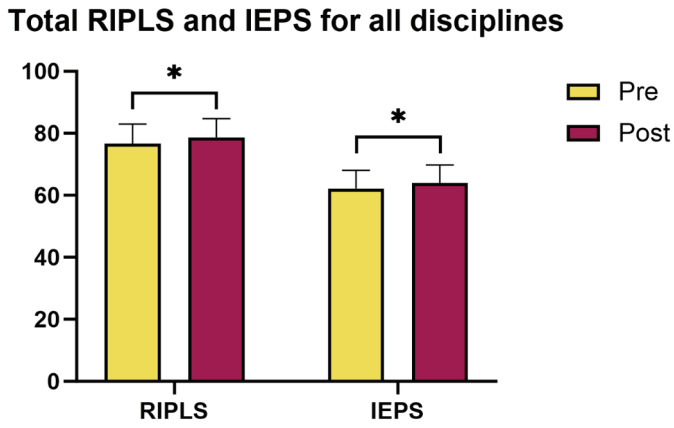

Figure 1. Mean total scores of the RIPLS and IEPS across students from all health sciences disciplines attending the IPE Anatomy Dissection elective years 2011–2020. (*) Significance denoted as $p < .05$.

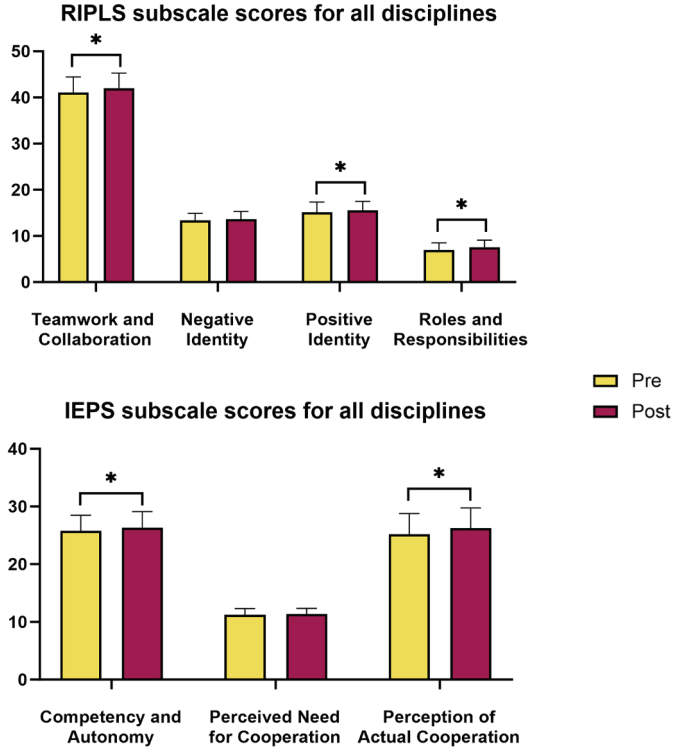

Figure 2. Mean RIPLS and IEPS subscale scores for students from all health sciences disciplines attending the IPE Anatomy Dissection elective years 2011–2020. (*) Significance denoted as $p < .05$.

Perception of Actual Cooperation (25.19 ± 3.60 vs 26.24 ± 3.50). Numerical data for the mean RIPLS and IEPS subscale scores are available in supplementary material (Table S1).

RIPLS and IEPS total and subscale scores within disciplines

Figure 3 presents the mean total and subscale scores for RIPLS, categorized by discipline. Mean total RIPLS scores were significantly different between pre and post elective for PA (76.94 ± 5.14 vs 78.75 ± 5.28, p = .03), PT (75.2 ± 7.10 vs 79.83 ± 5.50, p < .01), and RN (78.18 ± 5.39 vs 81.08 ± 4.64, p < .01). Significant pre and post elective mean differences were also observed in RIPLS subscale scores (Figure 3): Teamwork and Collaboration with PT (40.77 ± 3.26 vs 42.57 ± 2.49, p < .01) and RN (41.71 ± 3.19 vs 43.60 ± 2.15, p < .01); Negative Professional Identity with PT (13.07 ± 1.66 vs 13.7 ± 1.58, p = .02); Positive Professional Identity for PT (13.93 ± 3.19 vs 15.33 ± 2.04, p = .03); and Roles and Responsibilities with MD (6.29 ± 1.54 vs 6.77 ± 1.49, p < .01), PA (6.86 ± 1.51 vs 7.92 ± 1.5, p < .01), and PT (7.43 ± 1.48 vs 8.23 ± 1.13, p = .012). Numerical data for the mean RIPLS total and subscale scores for all disciplines are available in supplementary material (Table S2).

Figure 4 presents scores for the mean IEPS total and subscales as per discipline. Mean total IEPS was significantly different between pre and post elective scores for MD (58.79 ± 5.86 vs 60.20 ± 5.93, p = .05), OT (62.47 ± 4.33 vs 66.11 ± 3.82, p < .001), and PA (66.53 ± 4.02 vs 67.78 ± 3.67, p = .05). Significant pre- and post-elective mean differences were also observed in mean IEPS subscale scores (Figure 4): Competency and Autonomy for OT (25.18 ± 2.46 vs 26.97 ± 1.93, p < .001); and Perception of Actual Cooperation with MD (22.41 ± 3.81 vs 23.59 ± 3.74, p = .01), OT (26.26 ± 2.68 vs 28.0 ± 2.10, p < .001), and RN (25.81 ± 3.49 vs 27.05 ± 2.98, p = .04). Numerical data for mean IEP total and subscale scores for all disciplines are available in supplementary material (Table S3).

Pre and post RIPLS and IEPS scores over the years

Mean total RIPLS scores for all disciplines increased by 9.5% from 2015 to 2019 ($p = .003$) and from 2017 to 2019 ($p = .001$), respectively. Teamwork and Collaboration increased by 2.4% from 2015 to 2019 ($p = .01$), 0.2% from 2017 to 2019 ($p < .001$) and decreased by 4.7% from 2017 to 2020 ($p = .034$). Perception of Actual Cooperation increased by 16.7% from 2015 to 2017 ($p < .001$), 5.0% from 2016 to 2017 ($p < .001$) and decreased by 31.0% from 2017 to 2018 ($p < .001$) and 35.5% from 2017 to 2020 ($p = .01$). The mean differences between pre and post elective scores for each year is available in supplementary material (Table S4).

Discussion

To our knowledge, this is the first cross-sectional study evaluating students' IPE readiness and perceptions before and after an interprofessional anatomy dissection elective over 10 cohorts in seven health professional disciplines. Cumulative data analysis demonstrated that interprofessional anatomy learning often improved students' overall IPE readiness, as observed by changes in the mean RIPLS and IEPS total and subscale scores. There was no indication that IPE readiness was ever decreased by the elective. Improvements were noted in Teamwork and Collaboration, Positive Professional Identity, Roles and Responsibilities, Competency and Autonomy, and Perception of Actual Cooperation. There were significant differences in mean total and subscale scores for both questionnaires across several disciplines, particularly: RN for Teamwork and Collaboration; MD and PA for Roles and Responsibilities; and PT showing significant changes in mean RIPLS total and subscale scores. In contrast, MD, OT,

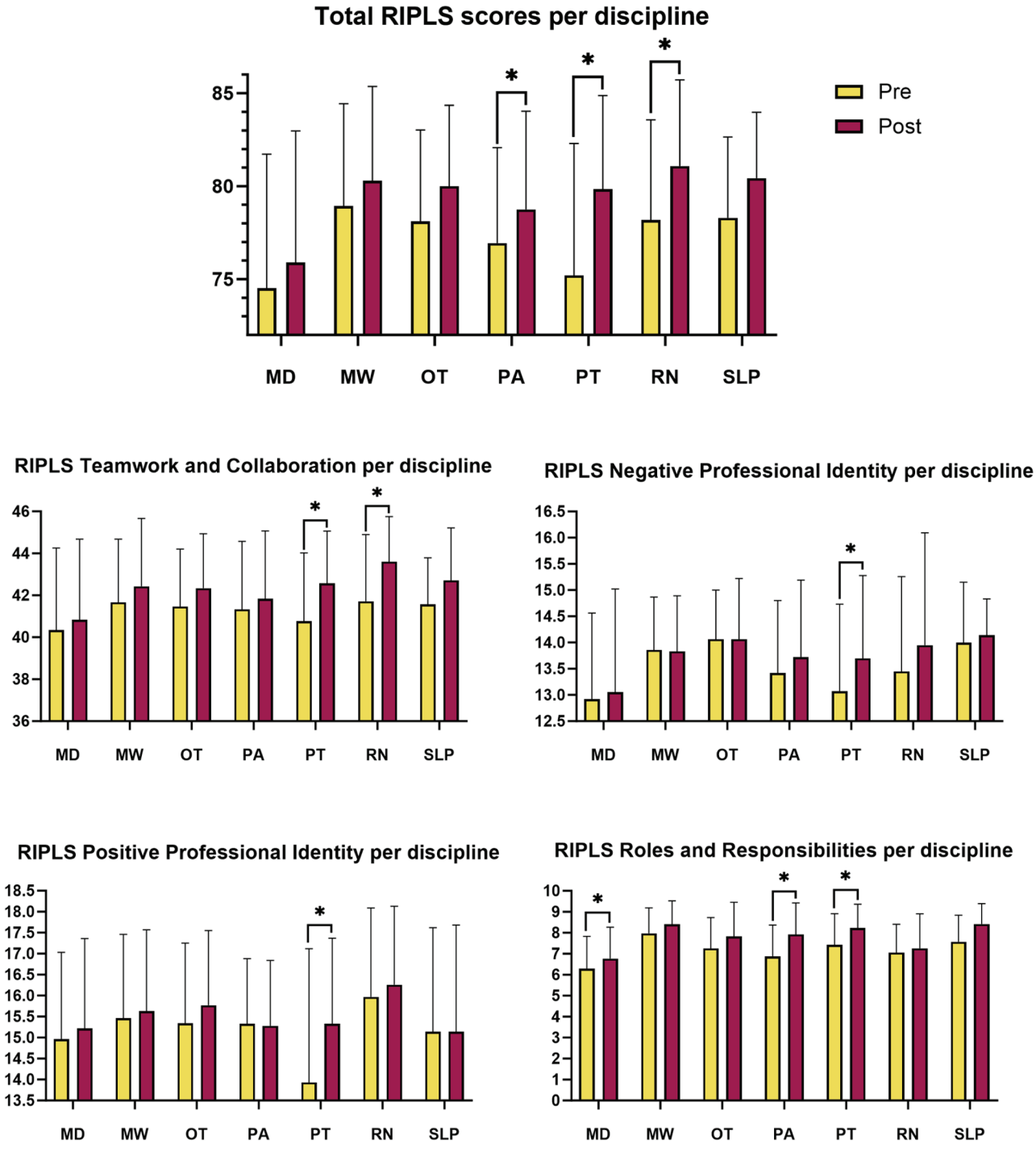

Figure 3. Mean RIPLS total and subscale scores per discipline for health sciences students attending the IPE Anatomy Dissection elective years 2011–2020. (*) Significance denoted as $p < .05$.

and PA showed significant changes in mean IEPS total scores, with OT for Competency and Autonomy, and MD, OT, and RN for Perceptions of Actual Cooperation.

The findings with the IPE Anatomy Dissection elective share some similarities to past interprofessional anatomy education initiatives reported in the literature, where interprofessional anatomy education initiatives led to improved appreciation for interprofessional collaborations and the responsibilities of each team member (González Blum et al., 2022; Hamilton et al., 2008; Herrmann et al., 2015; Shinoda et al., 2023). These past studies usually used RIPLS to measure students' perceptions and attitudes toward IPE. Since our data measured IPE readiness using RIPLS and IEPS in a larger interprofessional sample, these findings are strengthened - likely showcasing the intended and measured IPE constructs (Rajiah et al., 2016). To elaborate, RIPLS and IEPS have different constructs: RIPLS measures students' personal perceptions compared to IEPS which focuses on perceptions for their discipline (Lie et al., 2013). Furthermore, these questionnaires may be able to distinguish differences across subgroups

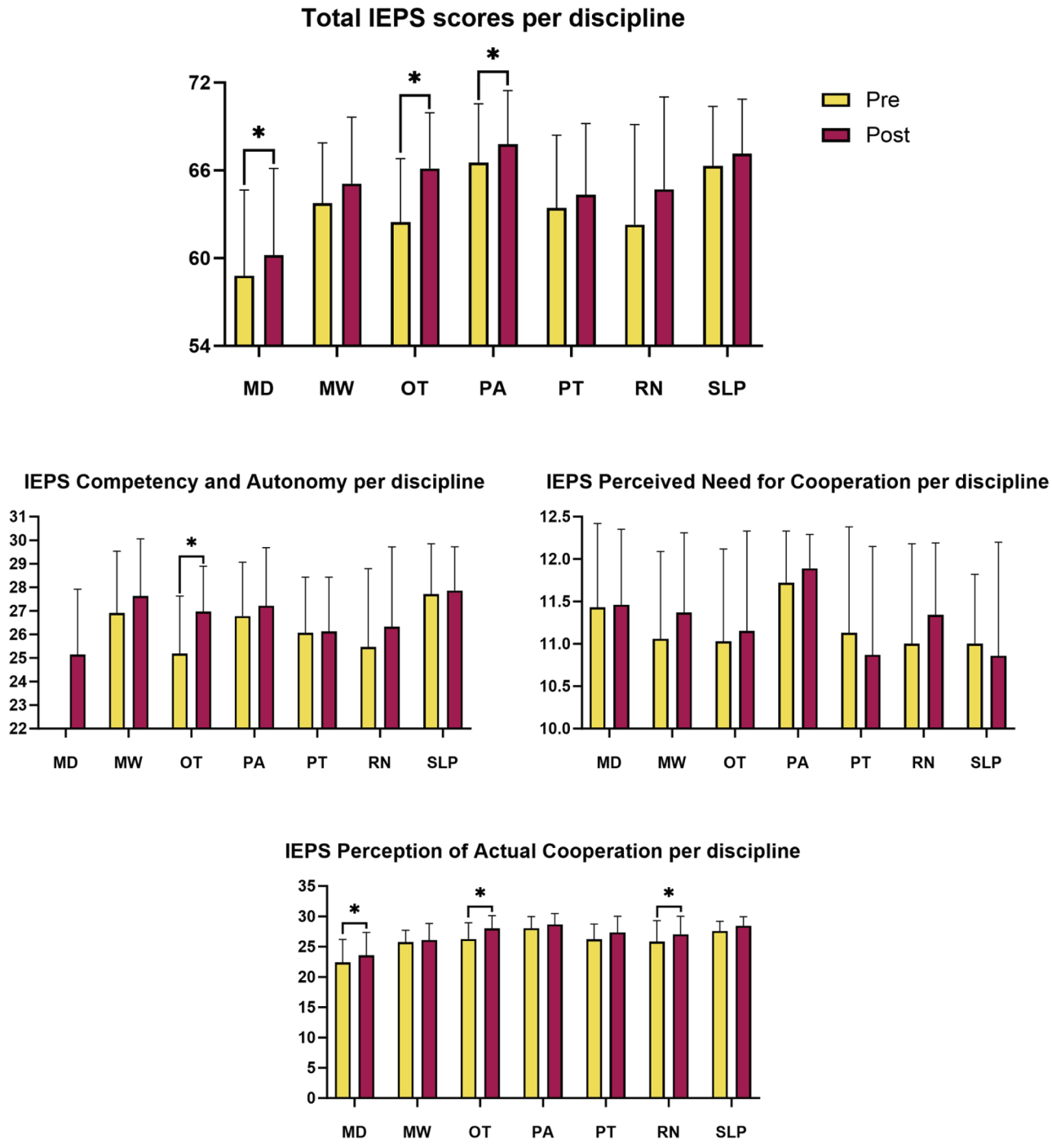

Figure 4. Mean IEPS total and subscale scores per discipline for health sciences students attending the IPE Anatomy Dissection elective from 2011–2020. (*) Significance denoted as $p < .05$.

including genders and junior versus senior students (Lie et al., 2013; Rajiah et al., 2016; Sciascia et al., 2021). Previous and level of IPE exposure could also be factors in score differences, as some studies have reported that RIPLS and IEPS were lower in students with little IPE exposure prior to the IPE event (González Blum et al., 2022; Lie et al., 2013; Sciascia et al., 2021). Factors such as age, prior IPE experiences and completing post-secondary education before entering their respective health professional programs may explain why certain disciplines showed improvements in specific subscales and questionnaires in this study. However, these factors were not collected in our study and as such, we can only hypothesize that these factors may have contributed to the observed improvements. In addition, this may explain the notable fluctuations in mean total and subscale scores in certain years. Several minor refinements to the elective may explain these changes. Content and clinical cases have not substantially changed over the years but have been refined to be equally relevant to all the disciplines involved and for clarity and inclusive language. Also, enrolment capacity increased from 28 to 34 in 2018, providing the opportunity for more students to interact with each other. Lastly, the incorporation of having

students give a five-minute lecture about their training and scope of practice of their future profession, likely strengthening relationships and their peers' understanding.

There were some similarities and differences in our cross-sectional results compared to the 2015 report published on this elective (Fernandes et al., 2015). Early evaluations of this elective included data from 2011 to 2014 and found significant improvements in the mean scores of three RIPLS and two IEPS subscales, similar to this 10-year cross-sectional dataset. This consistency demonstrates continued effectiveness with a larger sample size ($n = 264$), possibly attributed to the ongoing elective refinement and quality improvement, as feedback from the preceding year is used to shape the structure of next iteration. Although the elective has not undergone substantial modifications since inception, student feedback has informed small annual modifications, such as the addition of dedicated peer mentors, weekly agendas, and duration. These modifications may also explain some of the inconsistent differences in scores across certain years. A unique component of this elective is its facilitation by interdisciplinary peer mentors who complete the elective in the preceding year, allowing for student and mentor-led discussions for an enriched IPE experience. Additionally, students from SLP were included as of 2018, adding another perspective into the interprofessional anatomy learning experience. Despite these, improvements in IPE readiness and perceptions were steadily positive across the years, demonstrating the elective's ability to meet the goal of facilitating learners' interprofessional experiences. To our knowledge, this is a unique report in that it is an extensive report of students' perceptions toward IPE from seven disciplines compared to past studies with fewer disciplines at mutual IPE events (Cameron et al., 2009; Homeyer et al., 2018; Judge et al., 2015; Shinoda et al., 2023). We have evaluated the IPE perceptions within each annual cohort, and across a 10-year span, providing both short- and long-term evaluations of participants' IPE perceptions and experiences. The continuous positive IPE results are reassuring and contribute to our knowledge of how anatomy may be able to support the development or perceptions of IPE. Effective IPE program delivery and implementation include continuous cycles of data collection and improvements from participants' feedback (Anderson, 2016; Bogossian et al., 2023; Reeves et al., 2016; van Diggele et al., 2020).

Past studies have highlighted the importance of incorporating shared teaching and learning for IPE events, where key concepts are presented by each of the disciplines involved (González Blum et al., 2022; Hamilton et al., 2008). A literature review conducted by Abu-Rish et al. (2012) concluded at least 42% of the included IPE literature included studies evaluating two professions, and another 24% of the included IPE literature included four or more professions (Abu-Rish et al., 2012). In contrast, this study compared interprofessional attitudes across seven pre-licensure health professional students, thereby incorporating a broad range of student experiences and perspectives. Notably, significant changes in interprofessional attitudes were consistently shown in specific professions, namely PT, OT, RN, MD, RN, and PA, confirming findings from previous literature reporting program-specific changes to IPE interventions (Curran et al., 2010; Fernandes et al., 2015; González Blum et al., 2022; Hamilton et al., 2008; Herrmann et al., 2015; Meyer et al., 2017; Sytsma et al., 2015; Zheng et al., 2019). To facilitate an effective IPE experience, it is imperative to discuss how different professions fit in the context of the intervention (Abu-Rish et al., 2012; Azzam et al., 2022; Bogossian et al., 2023). Thus, our observations may be explained by how well aligned the included professions were in this elective's curriculum (i.e., clinical case discussions and scope of practice presentations). Furthermore, considering the anatomy focus of the elective, students from certain professional programs may express a greater appreciation toward dissecting in a collaborative setting due to different anatomy and dissection prerequisites or experiences in their programs. Throughout the years of this elective, students have expressed their appreciation toward learning and applying anatomical knowledge through dissections and carrying out clinical conversations relating to their dissection findings within their interprofessional teams (Fernandes et al., 2015; Mackinnon et al., 2022; Zheng et al., 2019). These findings emphasize the importance of utilizing foundational knowledges in health sciences, such as anatomy to create impactful IPE experiences.

Continued evaluation of this elective will include evaluating changes in IPE readiness based on student demographics, such as age, extent of previous IPE experiences, and prior education. Future IPE research will also work to identify the best IPE approaches and measure their effectiveness in fostering positive interprofessional collaborations and relationships in the workplace (Abu-Rish et al., 2012; Bogossian et al., 2023; Curran et al., 2010). Since inception, this elective's primary focus has been to hone participants' interprofessional knowledge and skills, with anatomy dissection as the mutual activity. However, anatomy competence is crucial in emerging healthcare professionals (Thistlethwaite, 2015), raising the need to evaluate students' learning in anatomy in this elective. We are working toward incorporating evaluations for this elective's effectiveness in other outcomes, such as students' change in anatomical and physiological knowledge. Furthermore, we hope this report serves as motivation for future studies to embrace ongoing evaluations to improve IPE interventions. Lastly, changes to IPE delivery during the recent COVID-19 pandemic and their effectiveness compared to the pre-pandemic era also warrants future investigation. A recent case study on the implementation of the Anatomy Dissections elective in a virtual setting demonstrates that students still develop interprofessional readiness when provided a structured communication platform (i.e., Microsoft Teams) to interact with their peers. However, when rating the anatomy experience, students continue to show a high preference for in-person delivery in the physical laboratory setting (Oliveira et al., 2023). Comparisons of student IPE learning experiences in the hybrid- and post-pandemic era are currently being explored.

Strengths and limitations

A strength of this study was the assessment of the IPE attitudes and perceptions of seven different disciplines (undergraduate and graduate leveled programs) across 10 years for a comprehensive IPE Anatomy Dissection elective. Additionally, the diversity of

students who consistently engaged in this elective was greater than reported in previous studies (Hamilton et al., 2008; Herrmann et al., 2015; Meyer et al., 2017; Sytsma et al., 2015). IPE attitudes and perceptions were also evaluated using two validated IPE scales – the IEPS and RIPLS. Both of these scales measure slightly different constructs, providing comprehensive insights to students' IPE readiness. Finally, the current literature identifies the need for longer IPE interventions assessed across multiple cohorts (Azzam et al., 2022), and our study is one of the few reported, possibly serving as a guide to support the development of future anatomy IPE interventions and evaluations.

The study had some limitations. The multidisciplinary composition of this elective remained relatively similar across the years; however, there were more students from the MD program than others who participated over the 10 years. Moreover, students from the SLP program were introduced into the elective from 2018 onwards, which diversified our student population, but still limits its broad applicability due to their small sample size. Furthermore, we acknowledge that not all possible members of interdisciplinary healthcare teams were involved in this elective, including but not limited to respiratory therapists, pharmacists, and dietitians, limiting the applicability of these results. There is also a potential for selection bias since students interested in this elective likely had a greater appreciation or willingness to engage in anatomy and IPE. Additionally, limited student demographic characteristics were collected, preventing the possibility of a subgroup analysis. Furthermore, we did not collect details on each students' program activities or extracurricular events during the time of participation. It is possible that changes in IPE perceptions may be the result of a cumulative effect of the IPE Anatomy Dissection elective and other activities they were involved in, including clinical placements, that occurred simultaneously. Finally, we acknowledge that RIPLS and IEPS have reported ceiling effects (Torsvik et al., 2021), with a lack of validation in several of the disciplines included in our study, warranting the need for these results to be interpreted with caution to other cohorts outside these years and disciplines (Oates & Davidson, 2015). However, a cautious interpretation of the consistent positive changes in RIPLS and IEPS across the different cohorts supports the positive impact the elective has on the students' IPE perceptions and readiness.

Conclusion

Improvements in students' attitudes and perceptions toward IPE were confirmed in this cross-sectional study assessed in the IPE Anatomy Dissection elective. Specifically, students gained a stronger appreciation for interprofessional collaboration, likely by improving their understanding of their own roles, responsibilities, and the contributions provided by other disciplines. This study demonstrated the potential of using interprofessional anatomy education as an effective method to facilitate IPE for students across disciplines who would not have interacted otherwise. Professional programs and future IPE initiatives may want to incorporate mandatory interprofessional anatomy education into their curricula to ensure all students will receive extensive IPE and training before entering the workplace.

Disclosure statement

SQ and YM were paid by PIPER to facilitate the interprofessional anatomy dissection elective in 2023; SQ is also paid as a research coordinator for PIPER. The remaining authors report there are no competing interests to declare.

Funding

This research was supported by the Education Program in Anatomy and the Program for Interprofessional Practice, Education and Research, McMaster University.

Notes on contributors

Shirley Quach is a registered respiratory therapist, assistant clinical professor in the School of Rehabilitation Sciences, and the research coordinator in the Program for Interprofessional Practice, Education and Research, Faculty of Health Sciences, McMaster University.

Sakshi Sinha is a Master of Science student in the Health Science Education Program, Faculty of Health Sciences, McMaster University.

Alexandra Todd is a medical student in the Michael G. DeGroote School of Medicine, McMaster University.

Andrew Palombella is an anatomical technician and demonstrator in the Education Program in Anatomy and Surgical Skills Laboratory, Faculty of Health Sciences, McMaster University.

Jasmine Rockarts is an anatomical technician and demonstrator in the Education Program in Anatomy and Surgical Skills Laboratory, Faculty of Health Sciences, McMaster University.

Sarah Wojkowski is the assistant dean (Physiotherapy), in the School of Rehabilitation Sciences and director of the Program for Interprofessional Practice Education and Research, Faculty of Health Sciences, McMaster University.

Bruce Wainman is the director of the Education Program in Anatomy and Surgical Skills Laboratory and associate professor in the Department of Pathology & Molecular Medicine, Faculty of Health Sciences, McMaster University.

Yasmeen Mezil is an assistant professor in the Education Program in Anatomy and Surgical Skills Laboratory and Department of Pathology & Molecular Medicine, Faculty of Health Sciences, McMaster University.

ORCID

Shirley Quach http://orcid.org/0000-0001-5693-3182
Sakshi Sinha http://orcid.org/0000-0001-8911-8037
Sarah Wojkowski http://orcid.org/0000-0002-8103-0281
Bruce Wainman http://orcid.org/0000-0001-7616-961X
Yasmeen Mezil http://orcid.org/0009-0008-4335-3873

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials. Additional data that support the findings of this study are available from the corresponding author, SQ, upon reasonable request.

References

Abu-Rish, E., Kim, S., Choe, L., Varpio, L., Malik, E., White, A. A., Craddick, K., Blondon, K., Robins, L., Nagasawa, P., Thigpen, A., Chen, L.-L., Rich, J., & Zierler, B. (2012). Current trends in interprofessional education of health sciences students: A literature review. *Journal of Interprofessional Care*, *26*(6), 444–451. https://doi.org/10.3109/13561820.2012.715604

Al-Qahtani, M. F. (2016). Measuring healthcare students' attitudes toward interprofessional education. *Journal of Taibah University Medical Sciences*, *11*(6), 579–585. https://doi.org/10.1016/j.jtumed.2016.09.003

Anderson, E. S. (2016). Evaluating interprofessional education: An important step to improving practice and influencing policy. *Journal of Taibah University Medical Sciences*, *11*(6), 571–578. https://doi.org/10.1016/j.jtumed.2016.08.012

Azzam, M. B., Ranieri, J., & Puvirajah, A. (2022). Interprofessional education in prelicensure health and social care professions education: A systematic review. *Health and Interprofessional Practice*, *4*(3), 2186. https://doi.org/10.7710/2641-1148.2186

Bogossian, F., New, K., George, K., Barr, N., Dodd, N., Hamilton, A. L., Nash, G., Masters, N., Pelly, F., Reid, C., Shakhovskoy, R., & Taylor, J. (2023). The implementation of interprofessional education: A scoping review. *Advances in Health Sciences Education*, *28*(1), 243–277. https://doi.org/10.1007/s10459-022-10128-4

Cameron, A., Rennie, S., DiProspero, L., Dematteo, D., DiProspero, L., Wagner, S., & Reeves, S. (2009). An introduction to teamwork: Findings from an evaluation of an interprofessional education experience for 1000 first-year health science students. *Journal of Allied Health*, *38*(4), 220–226. https://doi.org/10.1016/S0002-9459(24)00557-6

Canadian Interprofessional Health Collaborative. (2010). *A national interprofessional competency framework*. College of Health Disciplines, University of British Columbia.

Curran, V. R., Sharpe, D., Flynn, K., & Button, P. (2010). A longitudinal study of the effect of an interprofessional education curriculum on student satisfaction and attitudes towards interprofessional teamwork and education. *Journal of Interprofessional Care*, *24*(1), 41–52. https://doi.org/10.3109/13561820903011927

De Louche, C. D., Hassan, R., Laurayne, H. F., Wijeyendram, P., Kurn, O. R., Woodward, J., Sbayeh, A., Hall, S., & Border, S. (2023). Exploring the application of peer-assisted learning in practical neuroanatomy classes: A cohort comparison within a medical curriculum. *Medical Science Educator*, *33*(3), 687–699. https://doi.org/10.1007/s40670-023-01783-2

Fernandes, A. R., Palombella, A., Salfi, J., & Wainman, B. (2015). Dissecting through barriers: A mixed-methods study on the effect of interprofessional education in a dissection course with healthcare professional students. *Anatomical Sciences Education*, *8*(4), 305–316. https://doi.org/10.1002/ase.1517

González Blum, C., Richter, R., Fuchs, R., Sandeck, F., Kunz, K., & Heermann, S. (2022). Interprofessional education in medical and physiotherapy studies for future collaboration. *Annals of Anatomy - Anatomischer Anzeiger*, *240*, 151850. https://doi.org/10.1016/j.aanat.2021.151850

Guraya, S. Y., & Barr, H. (2018). The effectiveness of interprofessional education in healthcare: A systematic review and meta-analysis. *The Kaohsiung Journal of Medical Sciences*, *34*(3), 160–165. https://doi.org/10.1016/j.kjms.2017.12.009

Hamilton, S. S., Yuan, B. J., Lachman, N., Hellyer, N. J., Krause, D. A., Hollman, J. H., Youdas, J. W., & Pawlina, W. (2008). Interprofessional education in gross anatomy: Experience with first-year medical and physical therapy students at Mayo Clinic. *Anatomical Sciences Education*, *1*(6), 258–263. https://doi.org/10.1002/ase.59

Herrmann, G., Woermann, U., & Schlegel, C. (2015). Interprofessional education in anatomy: Learning together in medical and nursing training. *Anatomical Sciences Education*, *8*(4), 324–330. https://doi.org/10.1002/ase.1506

Homeyer, S., Hoffmann, W., Hingst, P., Oppermann, R. F., & Dreier-Wolfgramm, A. (2018). Effects of interprofessional education for medical and nursing students: Enablers, barriers and expectations for optimizing future interprofessional collaboration – a qualitative study. *BMC Nursing*, *17*(1), 13. https://doi.org/10.1186/s12912-018-0279-x

Judge, M. P., Polifroni, E. C., Maruca, A. T., Hobson, M. E., Leschak, A., & Zakewicz, H. (2015). Evaluation of students' receptiveness and response to an interprofessional learning activity across health care disciplines: An approach toward team development in healthcare. *International Journal of Nursing Sciences*, *2*(1), 93–98. https://doi.org/10.1016/j.ijnss.2015.01.003

King, S., Greidanus, E., Major, R., Loverso, T., Knowles, A., Carbonaro, M., & Bahry, L. (2012). A cross-institutional examination of readiness for interprofessional learning. *Journal of Interprofessional Care*, *26*(2), 108–114. https://doi.org/10.3109/13561820.2011.640758

Lie, D. A., Fung, C. C., Trial, J., & Lohenry, K. (2013). A comparison of two scales for assessing health professional students' attitude toward interprofessional learning. *Medical Education Online*, *18*(1), 21885. https://doi.org/10.3402/meo.v18i0.21885

Mackinnon, C., Akhtar-Danesh, N., Palombella, A., & Wainman, B. (2022). Using Q-methodology to determine students' perceptions of interprofessional anatomy education. *Anatomical Sciences Education*, *15*(5), 877–885. https://doi.org/10.1002/ase.2109

McFadyen, A. K., Maclaren, W. M., & Webster, V. S. (2007). The Interdisciplinary Education Perception Scale (IEPS): An alternative remodelled sub-scale structure and its reliability. *Journal of Interprofessional Care*, *21*(4), 433–443. https://doi.org/10.1080/13561820701352531

McFadyen, A. K., Webster, V., Strachan, K., Figgins, E., Brown, H., & McKechnie, J. (2005). The Readiness for interprofessional learning scale: A possible more stable sub-scale model for the original version of RIPLS. *Journal of Interprofessional Care*, *19*(6), 595–603. https://doi.org/10.1080/13561820500430157

Meyer, J. J., Obmann, M. M., Gießler, M., Schuldis, D., Brückner, A.-K., Strohm, P. C., Sandeck, F., & Spittau, B. (2017). Interprofessional approach for teaching functional knee joint anatomy. *Annals of Anatomy - Anatomischer Anzeiger*, *210*, 155–159. https://doi.org/10.1016/j.aanat.2016.10.011

Oates, M., & Davidson, M. (2015). A critical appraisal of instruments to measure outcomes of interprofessional education. *Medical Education*, *49*(4), 386–398. https://doi.org/10.1111/medu.12681

Oliveira, A., Wainman, B., Palombella, A., Rockarts, J., & Wojkowski, S. (2023). Piloting an interprofessional virtual cadaveric dissection course: Responding to COVID-19. *Anatomical Sciences Education*, *16*(3), 465–472. https://doi.org/10.1002/ase.2275

Parsell, G., & Bligh, J. (1999). The development of a questionnaire to assess the readiness of health care students for interprofessional learning (RIPLS). *Medical Education*, *33*(2), 95–100. https://doi.org/10.1046/j.1365-2923.1999.00298.x

Rajiah, K., Maharajan, M. K., Khoo, S. P., Chellappan, D. K., De Alwis, R., Chui, H. C., Tan, L. L., Tan, Y. N., & Lau, S. Y. (2016). Suitability of the RIPLS and IEPS for discriminating attitude differences towards interprofessional education among students of healthcare profession. *Education Research International*, *2016*, 1–6. https://doi.org/10.1155/2016/5946154

Reeves, S., Fletcher, S., Barr, H., Birch, I., Boet, S., Davies, N., McFadyen, A., Rivera, J., & Kitto, S. (2016). A BEME systematic review of the effects of interprofessional education: BEME Guide No. 39. *Medical Teacher*, *38*(7), 656–668. https://doi.org/10.3109/0142159X.2016.1173663

Sciascia, A., Christopher, K., Humphrey, C., Simpkins, L., Page, C. G., & Jones, L. G. (2021). Test/Re-Test reliability of the readiness for interprofessional education learning scale and interdisciplinary education perception scale in health science students. *Journal of Interprofessional Care*, *35*(1), 114–123. https://doi.org/10.1080/13561820.2019.1699038

Shenoy, A., & Petersen, K. H. (2020). Peer tutoring in preclinical medical education: A review of the literature. *Medical Science Educator*, *30*(1), 537–544. https://doi.org/10.1007/s40670-019-00895-y

Shinoda, K., Otsuka, S., Umemoto, K., Fukushige, K., Kurosawa, M., & Naito, M. (2023). Effect of interprofessional education on cadaver dissection seminar. *Anatomical Science International*, *98*(3), 434–440. https://doi.org/10.1007/s12565-022-00700-8

Singh, K., Bharatha, A., Sa, B., Adams, O. P., & Majumder, M. A. A. (2019). Teaching anatomy using an active and engaging learning strategy. *BMC Medical Education*, *19*(1), 149. https://doi.org/10.1186/s12909-019-1590-2

Sytsma, T. T., Haller, E. P., Youdas, J. W., Krause, D. A., Hellyer, N. J., Pawlina, W., & Lachman, N. (2015). Long-term effect of a short interprofessional education interaction between medical and physical therapy students. *Anatomical Sciences Education*, *8*(4), 317–323. https://doi.org/10.1002/ase.1546

Thistlethwaite, J. E. (2015). Interprofessional education and the basic sciences: Rationale and outcomes. *Anatomical Sciences Education*, *8*(4), 299–304. https://doi.org/10.1002/ase.1521

Torsvik, M., Johnsen, H. C., Lillebo, B., Reinaas, L. O., & Vaag, J. R. (2021). Has "the ceiling" rendered the Readiness for Interprofessional Learning Scale (RIPLS) Outdated? *Journal of Multidisciplinary Healthcare*, *14*, 523–531. https://doi.org/10.2147/JMDH.S296418

Trullàs, J. C., Blay, C., Sarri, E., & Pujol, R. (2022). Effectiveness of problem-based learning methodology in undergraduate medical education: A scoping review. *BMC Medical Education*, *22*(1), 104. https://doi.org/10.1186/s12909-022-03154-8

van Diggele, C., Roberts, C., Burgess, A., & Mellis, C. (2020). Interprofessional education: Tips for design and implementation. *BMC Medical Education*, *20*(2), 455. https://doi.org/10.1186/s12909-020-02286-z

World Health Organization. (2010). *Framework for action on interprofessional education & collaborative practice (WHO/HRH/HPN/10.3)*. Health Professions Network Nursing and Midwifery Office. http://www.who.int/hrh/nursing_midwifery/en/

Zheng, Y. H. E., Palombella, A., Salfi, J., & Wainman, B. (2019). Dissecting through barriers: A follow-up study on the long-term effects of Interprofessional education in a dissection course with healthcare professional students. *Anatomical Sciences Education*, *12*(1), 52–60. https://doi.org/10.1002/ase.1791