Piloting an interprofessional virtual cadaveric dissection course: Responding to COVID-19

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Abstract

Interprofessional learning improves students' clinical and interprofessional competencies. COVID-19 prevented delivering in-person education and motivated the development of a virtual interprofessional cadaveric dissection (ICD) course. This study reports on the effects of a virtual ICD course compared to a previously delivered in-person course, on students' readiness for, and perceptions about, interprofessional learning. Students attending the ICD course in-person (2019-2020) or virtually (2020-2021) completed the Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS). Students in the virtual course also provided written feedback. Thirty-two (24 women; Median: 24 [Q1-Q3: 22-25] years) and 23 students (18 women; 22 [21-23] years) attended the in-person and virtual courses, respectively. In the virtual cohort, the RIPLS total score (82 [76-87] vs. 85 [78–90]; p=0.034) and the roles and responsibilities sub-score (11 [9–12]) vs. 12 [11–13]; p = 0.001) improved significantly. In the in-person cohort, the roles and responsibilities sub-score improved significantly (12 [10-14] vs. 13 [11-14]; p=0.017). No significant differences were observed between cohorts (p < 0.05). Themes identified in the qualitative analysis were advantages and positive experiences, competencies acquired, disadvantages and challenges, and preferences and suggestions. In-person and virtual ICD courses seem to have similar effects on students' interprofessional learning. However, students reported preferring the in-person setting for learning anatomy-dissection skills.

KEYWORDS

anatomy education, COVID-19, interprofessional education, online course delivery

INTRODUCTION

Anatomy education is a cornerstone of training for healthcare professionals.¹ Specifically, cadaveric dissection is a key strategy for teaching anatomy skills to different healthcare programs.² Previous research demonstrated delivering a cadaveric dissection course in an interprofessional environment improves students' clinical skills, role clarity, and attitudes toward other health professions.³⁻⁵

The interprofessional cadaveric dissection (ICD) course has been offered at McMaster University since 2009, to help fulfill curriculum requirements for interprofessional education from accreditation bodies in health programs.^{6,7} However, the COVID-19 pandemic

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made. © 2023 The Authors. Anatomical Sciences Education published by Wiley Periodicals LLC on behalf of American Association for Anatomy. prevented in-person delivery of this course and motivated the development of a virtual alternative. Previous studies have shown the virtual environment allows for the acquisition of communication and role clarification competencies, in an environment less burdened by professional hierarchies.⁸ Virtual learning has also been shown to yield positive results in the teaching of anatomy, as demonstrated by improved academic performance and positive qualitative feedback from students. This approach offers advantages such as the ability to isolate and appreciate anatomical structures, time-efficiency, and the opportunity to visualize structures multiple times.^{1,9} However, the studies that have been conducted did not address interprofessional learning or involve students meeting in-person to use virtual computer-based dissection programs.^{1,9}

This study aims to compare the effects of a virtual ICD course with a previously delivered in-person course on students' readiness for and perceptions about interprofessional learning.

METHODS

A mixed-methods study was designed. Two student cohorts who attended an ICD course in-person (2019–2020) or virtually (2020–2021) were asked to complete the Readiness for Interprofessional Learning Scale (RIPLS)¹⁰ and the Interdisciplinary Education Perception Scale (IEPS)¹¹ prior to starting, and at course completion.

The RIPLS scale consists of 19 statements for which students rank their personal agreement using a 5-point Likert scale (1=strongly disagree, 5=strongly agree). Importantly, negative statements (items 10–12, 17–19) are scored in reverse such that a higher overall score indicates a higher readiness for interprofessional learning. The scale can be interpreted as a whole score (average of the sum of Likert rankings across all 19 items) and in four subscales: teamwork and collaboration (items 1–9), negative professional identity (items 10–12), positive professional identity (items 13–16), and roles and responsibility (items 17–19). The total score of this scale ranges from 19 to 95 with higher scores indicating greater readiness for IPE.¹⁰

The IEPS is a 12-item tool with a 6-point scale (1=strongly disagree, 6=strongly agree) composed of three subscales: competence and autonomy (items 1, 5, 7, 10, and 13), perceived need for cooperation (items 6, 8), and perception of actual cooperation (Items 2, 14–17). The total score of this scale ranges from 12 to 72 with higher scores indicating greater readiness for IPE.¹¹

The scales were available for all students on their ICD course shell on Avenue to Learn approximately 3 weeks before the course initiation and 3 weeks after course completion. Virtual course participants were also asked to provide written feedback about: interaction, awareness, respect, trust, experiences, collaborations, advantages, disadvantages, and modifications at the end of the course. Completing the questionnaires was optional for students; those who chose to complete the questionnaires were assigned a unique predetermined code to ensure anonymity. Table 1 contains the open-ended questions that were asked to students after the virtual ICD course.

TABLE 1 Open-ended questions on the virtual cohort survey.

Question 1

- Considering the virtual anatomy dissection course:
- a. Please describe how it differed from in-person courses in terms of interaction with others.
- b. Please describe how it differed from in-person courses in terms of awareness of roles of other health professionals.
- Please describe how it differed from in-person courses in terms of respect for each other's roles.
- d. Please describe how it differed from in-person courses in terms of trust in each other's' competency.

Question 2

Please describe experiences in the online anatomy course that were important to you

Question 3

How will this virtual experience impact your future collaboration with other members of the health-care team?

Question 4

What do you consider to be the main advantage for interprofessional learning of using a virtual dissection environment?

Question 5

What do you consider to be the main disadvantage for interprofessional learning of using a virtual dissection environment?

Question 6

What (if at all) do you think could be modified in the virtual dissection course to enhance your interprofessional learning experience?

This study was approved by the Research Ethics Board (REB) for Hamilton Health Sciences/Faculty of Health Sciences at McMaster University and data collection did not occur until after informed consent was obtained from participants.

The structure of the original in-person course³ was adapted to the virtual setting. Table 2 presents a comparison between the in-person and virtual courses. Briefly, the in-person course consists of 10weeks, 3-h weekly sessions composed of a presentation of the scope of practice of one of the professions represented in the course (~10min); an anatomy presentation related to the week's dissection (~10 min); interprofessional case study discussion in a problem-based learning format about a topic relevant to the week's dissection (~40min); and interprofessional dissection (~120 min). The presentations on the professions' scope of practice and anatomy are delivered by student coordinators, who have completed the course in previous year, to the large group. These same student coordinators help to facilitate the case study discussions and dissections, which are performed in groups of 7-8 students from different disciplines. No formal assessment of the students' interactions throughout the session is implemented. Two prosectors were responsible for preparing the cadavers for each week's dissection (i.e., moving the cadavers from the cold room to the dissection room and cleaning them up for excess fluid) and monitoring/guiding students during the dissections. An in-house course manual, including dissection guide and case

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TABLE 2 Differences between in-person and virtual cadaveric dissection courses.

	In-person course (2019–2020)	Virtual course (2020–2021)
Course timing	 10' Presentations on the professions' scope of practice One presentation 10' Anatomy presentation 40' Case study discussion Four groups of eight students 90'-120' Cadaveric dissection 	 20' Presentations on the professions' scope of practice Two presentations 10' Anatomy presentation 40' Case study discussion Four groups of 7-8 students 40' Virtual cadaveric dissection
Content	 Integument Upper limb (MSK and neurovasculature) Lower limb (MSK and neurovasculature) Cardiorespiratory Gastrointestinal Renal Reproductive Head and neck (neuroanatomy) 	 MSK Cardiorespiratory Gastrointestinal and urogenital Head and neck and the central nervous system
Session duration and frequency	10 weeks, 3 h/week	4 weeks, 2 h/week, alternate weeks
Resources	 Four cadavers for dissection Two staff for setup, clean-up, and supervision 6-8 coordinators for case study discussion, presentations on the professions' scope of practice, and leading dissection groups 	 One cadaver for dissection Prerecorded videos of cadaveric dissection Two demonstrators for "live" voiceover of dissections Seven coordinators for case study discussion supervision Computer with Internet connection and Microsoft Teams

Abbreviation: MSK, musculoskeletal; 'minutes.

studies, is distributed prior to the start of the program. Each year, the pre-course preparation time for the in-person course, including selecting appropriate donors, going through the case studies and course manuals and organizing coordinator presentations, is approximately 12 h.

Compared with the in-person course, the virtual course preserved the same session structure but was shorter in its length (4 weeks, 2 h/week, alternate weeks), reduced the breadth of content provided (four anatomy-physiologic contents instead of eight in the in-person course), and limited student interactions in small groups to the case study discussion (i.e., students would be divided in groups of 7-8 into breakout rooms). To shorten the duration of the course, the primary areas to be covered, including musculoskeletal, abdomen, thorax, and neuro, were combined into a single session for each. For example, the in-person course usually covers musculoskeletal material in three sessions, but in the virtual course, it was covered in a single session. A major difference between the two course formats was how dissection was instructed. Due to the impossibility of performing in-person dissections secondary to COVID-19 restrictions, participants in the virtual course viewed prerecorded speeded-up videos of cadaveric dissection with live commentary and descriptions from the two prosectors. During the videos, participants were encouraged to ask questions using the chat or through using their microphones and were posed questions by the prosectors to facilitate interaction. The preparation time of the virtual course was approximately 70h and included time for a full donor dissection, video editing

and weekly meetings over the fall term (13 weeks) with the anatomy and interprofessional unit leaders, the research coordinator, and the dissection professionals.

Data analysis was conducted in Microsoft Excel or Statistical Package for Social Scientists (SPSS), version 26 for Windows (IBM Corp., Armonk, NY) and plots were created using GraphPad Prism Version 5.01 (GraphPad Software, San Diego, CA, USA).

Demographic characteristics (i.e., age, gender, program, and previous interprofessional education experience) were compared between cohorts using Wilcoxon signed-rank test or Chi-square test. Pre- and post-course RIPLS and IEPS scores within groups were compared using the Mann-Whitney *U* test and pre-post differences were calculated for each group and compared using Wilcoxon signed-rank test. Statistical significance was considered for *p*<0.05. Qualitative data from written feedback was thematically analyzed independently by two members of the research team.¹²

RESULTS

Thirty-two and 23 students attended the in-person and virtual courses and were invited to complete pre- and post-surveys, respectively. Seven students in the virtual cohort did not fill in the post-course questionnaires, but no differences were found in the demographic characteristics of students completing the scales and those who decided not to complete them.

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TABLE 3 Demographic characteristics of students attending the in-person (2019–2020) and virtual (2020–2021) interprofessional cadaveric dissection course.

	In-person course (2019–2020) n = 32	Virtual (2020-2021) n = 23	p-value
Age, median [IQR]	24 [22-25] years	22 [21-23] years	0.038*
Gender, female (%)	27 (84.4)	18 (80.0)	0.562
Program, n (%)			
Medicine	10 (31.3)	6 (26.1)	0.997
Midwifery	4 (12.5)	3 (13.0)	
Nursing	5 (15.6)	3 (13.0)	
Physician assistant	3 (9.4)	2 (8.7)	
Physiotherapy	4 (12.5)	3 (13.0)	
Occupational therapy	4 (12.5)	4 (17.4)	
Speech language pathology	2 (6.3)	2 (8.7)	
Previous IPE experience, yes (%)	9 (28.1)	4 (17.4)	0.355

Abbreviations: IPE, interprofessional education; IQR, interquartile range.

*p<0.05.

TABLE 4 Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS) scores of students attending the in-person (2019–2020) and virtual (2020–2021) cadaveric dissection course: pre-course (Pre) and post-course (Post).

	In-person (n=32)			Virtual ($n=2$:3)			Diff.	
	Pre	Post	p-value	Pre	Post	p-value	Diff. in-person (n = 32)	virtual (n = 23)	p-value
RIPLS									
Total	85.5 [76-87]	88 [78.3-91]	0.434	82 [76-87]	85 [78-90]	0.034*	1 [-2.8 to 5]	4 [-1 to 6]	0.293
T&C	42 [39-44]	42.5 [37-45]	0.596	41 [37-44]	41 [37-44]	0.251	0 [-2 to 2]	1 [-1 to 2]	0.254
NPI	14 [13-14]	14 [13-15]	0.506	13 [12-14]	13 [12-14]	0.123	0 [-1 to 1]	0 [0-1]	0.679
PPI	19 [16-20]	19 [16.3-20]	0.507	18 [16-19]	18 [16-19]	0.858	0 [-1 to 1]	0 [-1 to 1]	0.714
R&R	12 [10.3-13.8]	13 [11-13.8]	0.017*	11 [9-12]	12 [11-13]	0.001*	1 [0-2]	1 [0-2]	0.316
IEPS									
Total	64 [26-69]	65 [60.3-68.8]	0.431	65 [62-70]	66 [60-70]	0.930	0 [-2 to 3]	1 [-3 to 3]	0.837
C&A	26 [24-28.8]	26 [25-29]	0.225	28 [26-30]	28 [25-30]	0.187	0 [-1 to 2.8]	0 [-3 to 1]	0.151
PNC	12 [11-12]	12 [11-12]	0.857	12 [10-12]	12 [11-12]	0.750	0 [-1 to 0.8]	0 [-1 to 1]	0.892
PAC	26.5 [24.3-29]	27 [25-29]	0.584	28 [23-30]	27 [25-29]	0.344	0 [-1 to 1.8]	0 [-1 to 1]	0.628

Note: Data are presented as median [interquartile range]. RIPLS Total MS is 95 points. IEPS Total MS is 72 points.

Abbreviations: C&A, Competence and Autonomy Subscale (maximum score – MS 30 points); NPI, Negative Professional Identity Subscale (MS 15 points); PAC, Perception of Actual Cooperation Subscale (MS 30 points); PNC, Perceived Need for Cooperation Subscale (MS 12 points); PPI, Positive Professional Identity Subscale (MS 20 points); R&R, Roles, and Responsibilities Subscale (MS 15 points); T&C, Teamwork and Collaboration Subscale (MS 45 points).

*p < 0.05.

Table 3 presents participant demographics. Participants who attended the in-person course were older than those who attended the virtual course. No other differences between cohorts were noted. for the virtual cohort and the RIPLS roles and responsibilities subscore for both cohorts (Figure 1). No other statistically significant differences were found.

Quantitative data: RIPLS and IEPS

 Table 4 presents cohorts' scores in the RIPLS and IEPS scales. Pre

 and post-course differences were observed in the RIPLS total score

Qualitative data: Open-ended questions

Themes identified were advantages and positive experiences, competencies acquired, disadvantages and challenges, and preferences and suggestions (Table 5).

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FIGURE 1 Readiness for Interprofessional Learning Scale (RIPLS) and the Interdisciplinary Education Perception Scale (IEPS) RIPLS and IEPS scores of students attending the in-person (2019–2020) and virtual (2020–2021) cadaveric dissection course pre-course (Pre) and post-course (Post). Scores did not differ significantly between in-person and virtual cohorts.

Participants agreed the online course was innovative, convenient, and a well-structured alternative to the in-person course. Through this course, participants acquired knowledge about their own and other health professionals' roles in the multidisciplinary team. They noted this knowledge improved their trust in the team and would ultimately benefit a multidisciplinary approach toward patients. However, virtual learning was not without challenges. Delivering the course online made team interactions more difficult, and participants commented on a lack of learning handling skills specific to dissection.

For future online courses, students suggested expanding the time dedicated to each case study and broadening the case studies' scope.

DISCUSSION

This is the first study to compare a virtual ICD course with an inperson offering. It suggests in-person and virtual ICDs have similar effects in readiness for, and perceptions about, interprofessional learning. Participants attending the virtual course acknowledged the innovation, convenience, and positive influence of the course on interprofessional competencies but reported preferring in-person environment for learning anatomy dissection skills.

A significant number of studies have reported the impact of interprofessional interventions^{13,14}; however, establishing direct comparisons with their outcomes is difficult, due to the heterogeneity of outcome measures used. Our RIPLS total score is similar to those published by our group using a larger simple size of 97 participants,³ and those from a recent randomized controlled trial in Japan.¹⁴ The improvements in participants' roles and responsibilities over the course of the intervention, are also observed in studies that use measures other than the RIPLS (e.g., Interprofessional Collaborative Competencies Attainment Survey, KidSIM Team Performance Scale).^{15,16} The IEPS scores from our study, in contrast to the literature, did not differ significantly before and after the course. Before the course, students' scores were already close to the maximum IEPS score and post-course improvements were small. Considering the small sample size enrolled in the ICD, it is possible our study was not powered to capture the significance of these small changes. In a previous study of the IP dissection elective using several years of IEPS data significant improvements were found.³

No significant differences were found in the differential between pre- and post-scores of the RIPLS and IEPS between in-person and virtual cohorts. This is not surprising since participants feedback about the virtual course in our study match those from studies on in-person learning. Specifically, reports about increased awareness of others/own roles and how to work on a multidisciplinary team to improve patients' care have been reported.^{17,18} Similar to our study, these in-person interventions were also short in duration (i.e., 1-3 day sessions), which may suggest short but intensive interventions are effective in improving awareness for the needs and benefits of interprofessional work. Future studies exploring the course duration as the only independent variable are needed to confirm this hypothesis.

On the other hand, participants emphasized the lack of hands-on skills in the virtual course was a disadvantage. These results align with results from a survey conducted with students from India during the pandemic¹⁹ and a previous study by our group; the latter study showed virtual resources may have disadvantages compared to traditional specimens in learning anatomy,²⁰ as it does not completely mimic the real-life interprofessional interaction in the workplace. In these studies, however, virtual components were an alternative to, and not in addition to, in-person learning. Recent literature has reported clear benefits of using virtual learning components complementary to in-person learning in areas such as course grades and self-reported understanding of anatomy.^{21,22} Overall, it seems that while virtual interprofessional courses may be a viable option to increase students' interprofessional skills when there is no alternative, they appear to be more effective when combined with traditional in-person resources for mastering clinical skills.^{23,24} Applying the knowledge generated by this investigation, we are now considering how to integrate hybrid anatomy dissection courses using the virtual learning material prepared in future IPE offerings. The ability

TABLE 5 Theme, subthemes, and representative quotes of participants written feedback about the virtual interprofessional anatomy dissection course.

Themes	Subthemes	Representative quotes (name*, age, and program)
Advantages and positive experiences	Innovative	"This course has provided an experience that is different from typical classes in my program." Student 1, female, 22 years (Occupational Therapy)
	Engagement with other programs	"I really enjoyed interacting with people from different programs and collaborating together to advance our learning" Student 2, female, 18 years (Nursing)
	Course content and organization	"The online format was well-planned and it was easy to communicate with others using the breakout rooms." Student 3, female, 18 years (Nursing)
	Professionalism of participant	"I really loved the thoughtfulness and respect that was always emphasized and paid to the donors and their families." Student 4, female, 23 years (Physician assistant)
	Accessibility and convenience	"Very convenient and easy to get everyone together! Sometimes preceptors were able to take the call from the hospital in the middle of their shift!" Student 5, female, 21 years (Medicine)
Disadvantages and challenges	Difficult to interact/ engage	"I find online interaction difficult especially when there's pauses because people are unsure of who wants to speak." Student 1, female, 23 years (Physiotherapy)
	Course content and organization	"Increased my awareness of SLP roles but found that cases were not appropriate for exploring the midwifery scope of practice" Student 6, female, 34 years (Midwifery)
	Hands-on skills	"Experiences in-person with the cadaver, feeling, touching and examining the specimens in real life would give me a greater appreciation for the anatomy" Student 7, female, 24 years (Physician assistant)
	Challenging aspects	"I think people may be more hesitant to participate online. I personally found it more intimidating to speak up on a virtual platform than I think I would have in-person." Student 8, female, 20 years (Midwifery)
Competencies acquired	Awareness of others/own roles	"There were a few other professions I was unaware of or had only known existed but did not know their scope of practice. This experience allowed me to better understand my role in a health care environment and know that there are many specialists that will be able to provide similar or better care for overall improved patient outcomes." Student 9, male, 23 years (Medicine)
	Academic skills	"Everyone comes from different background but we all come together to learn the same information with our own individual ways of thinking. It is a great way to work on clinical thinking and communication skills." Student 10, male, 22 years (Physiotherapy)
	Multidisciplinary approach	"I have always known that healthcare is a team environment and that physicians are just one component of that team, but did not really know how everyone's roles fit together. This experience put that into perspective and allowed me to see how it might really play out in a clinical environment." Student 9, male, 23 years (Medicine)
	Trust in other HCP	"Understanding the understanding, training, certification, and regulations required for each healthcare profession and seeing each other's application of that knowledge further solidified my trust in each other's competency." Student 4, female, 23 years (Physician assistant)
Preferences and suggestions	Content improvement	"Case study questions related most to PT and MD, so more broad engagement could be helpful for other students." Student 10, male, 32 years (Physiotherapy)
	Structure improvement	"Provide more information on how each speciality would treat a specific case. There wasn't a lot of time for discussion in the tutorial groups." Student 11, female, 24 years (Medicine)
	No suggestions	"Nothing I can think of!" Student 12, female, 23 years (Speech language pathology)
	Preferences	"While the virtual dissection videos were great, anatomy is best appreciated and learned in-person." Student 10, male, 22 years (Medicine)

to reuse the virtual material in future courses will not only optimize the great initial investment in course preparation but also reduce the faculty burden.

This study has some limitations that should be acknowledged. First, this exploratory study enrolled a small sample size, which may have been underpowered to find effects on the outcomes studied and prevented sub-analysis by different disciplines. Second, students from the virtual cohort were younger and had a larger dropout rate for the post-course survey compared to those in the in-person cohort. Third, we did not measure knowledge acquisition outcomes, therefore, we cannot objectively determine the impact of the in-person and/or virtual programs on students' anatomy competencies. Moreover, the courses, although conceptually similar, covered different anatomy content with students in the virtual course not going into as much depth in topic areas as they typically would in an 8- or 10-week course. Also, the courses differed in frequency and duration, which may have influenced the results. Finally, we did not collect participants' past experiences or teachings related to interprofessional learning and as such, we cannot determine how their past experiences with interprofessional education may have influenced the results of this study. However, this study is unique in showing the feasibility of a completely virtual cadaveric dissection course with an interprofessional student cohort. Studies with robust designs, including outcome measures for anatomy knowledge and a larger sample of different discipines are needed to establish the effectiveness of this intervention.

CONCLUSIONS

In-person and virtual ICD courses have similar effects in student's readiness for, and perceptions about, interprofessional learning. Participants attending the virtual course acknowledged the innovation, convenience, and positive influence of the course in their interprofessional competencies but reported preferring an in-person environment for learning anatomy dissection skills.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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