# Interprofessional team-based education: A comparison of in-person and online learner experiences by method of delivery and health profession

Allison Shorten [a,b,*], Brett Shorten [b], Peter Bosworth [b], Shelly Camp [b], David House [a], William Somerall [a], Penni Watts [a,b]

[a] School of Nursing, University of Alabama at Birmingham (UAB), 1701 University Blvd., Birmingham 35294, United States
[b] UAB Office of Interprofessional Curriculum, University of Alabama at Birmingham, 1701 University Blvd., Birmingham 35294, United States

ABSTRACT

*Background:* Building capacity for teamwork, communication, role clarification and recognition of shared values is essential for interprofessional healthcare workforce development. Requirements to demonstrate interprofessional practice competencies have coincided with pivots to online delivery. Comparison of in-person and online delivery models for interprofessional education is important for future curriculum design.
*Purpose:* This article presents an evaluation of in-person and online delivery modes for interprofessional team-based education and compares learner experiences across different health professions.
*Methods:* Students from 13 health professions ($n = 2236$) participated between Spring 2020 and Fall 2021. In-person and online delivery models were compared, assessing learner perceptions of efficacy for interprofessional practice, using reflective pre-post responses to the Interprofessional Collaborative Competency Attainment Scale (ICCAS).
*Results:* Mean ICCAS scores improved for in-person and online delivery (0.79 vs 0.66), with strong effect (Cohen's D 2.03 and 1.31 respectively; $p < 0.001$). Statistically significant differences were observed across professions, although all experienced ICCAS score improvements. Logistical benefits were evident for online delivery.
*Conclusion:* In-person and online interprofessional team-based education can provide valuable learner experiences for large student cohorts from multiple professions. ICCAS score differences should be weighed against potential logistical benefits of online delivery. Timing of delivery and determinants of differences in student response across professions warrant evaluation for future curriculum design.

## Introduction

### Background

It is well-established that collaborative, team-based care improves safety and quality in healthcare (Brown & Kushner Benson, 2020; Isibel et al., 2018; Labrague et al., 2018). In the context of the COVID-19 pandemic, there has been greater recognition of interprofessional team-based care models as crucial for improving outcomes and sustaining an effective and healthy workforce (Barret & Lamb, 2020). Evidence-based approaches to interprofessional education are necessary, as we seek to prepare students for the future realities of healthcare beyond the COVID-19 pandemic. Building capacity for effective teamwork, communication, role clarification and confidence in interprofessional practice is essential, yet designing and implementing effective activities across diverse healthcare curricula with limited resources and infrastructure constraints has long been challenging (Nelson et al., 2017). This challenge has been elevated during swift pandemic pivots from in-person to online Inter Professional Education (IPE) events, increasing pressure upon educators to adopt new online technologies while simultaneously motivating and engaging learners. Creating and engaging communities of interprofessional learning through technological environments such as video conferencing platforms have often been pragmatic, with little time to pause, evaluate and reflect. This article presents a timely comparison of an in-person versus online interprofessional team-based education experience through the lens of quality improvement, to inform decisions about future delivery of IPE programs across an academic medical center in the United States

\* Corresponding author.
*E-mail addresses:* ashorten@uab.edu (A. Shorten), bshorten@uab.edu (B. Shorten), bosworth@uab.edu (P. Bosworth), scamp6@uab.edu (S. Camp), dthouse@uab.edu (D. House), wsomeral@uab.edu (W. Somerall), piwatts@uab.edu (P. Watts).

(US).

### Interprofessional Team Training (IPTT): history and development

Prior to COVID-19, there were already numerous challenges in coordinating and delivering effective IPE experiences, using large in-person interprofessional events to reach multiple professions in the limited time assigned within health professions curricula. Over a decade ago, a large scale in-person event, named "Interprofessional Team Training" or "IPTT", was launched at our academic institution (Rothrock et al., 2013) with the aim of providing an interprofessional team-based learning experience for as many students as possible, from a wide variety of health professions. Initially delivered twice each year as a half-day event, approximately 400 students from up to 13 different professional programs were brought together to observe an in-person patient interview conducted by a panel of different professions. Students were assigned to work in groups of up to 25 with a trained facilitator, to identify patient problems and develop a plan of care to improve their health status. IPTT was designed to encourage interprofessional student communication and teamwork, recognizing the different roles and responsibilities of other health professions (Hitchcock et al., 2020; Rothrock et al., 2013). Consistent with Contact Hypothesis and associated theoretical approaches to designing interprofessional education (Hean & Dickinson, 2005; Carpenter & Dickinson, 2016), facilitators were trained to ensure students perceived they had *equal status* within the group, established *common goals* and cooperated to achieve them together, were aware that there was *institutional support* and a *positive expectation* of importance of the event for learning and future practice. Students were asked to take on the role of their profession.

Further development of the program led to using a video-recorded standardized patient interview. Students were encouraged by the facilitator to begin to communicate with each other as they identified patient needs, taking into account the patient's medical, social, environmental and economic factors. Students were encouraged to reflect on their own attitudes, values, viewpoints and experiences while exploring the attitudes, values and viewpoints of other healthcare professions. The facilitator provided guidance for learners to identify patient problems and priorities, as they worked together to create a team-based care plan. Discussions addressed similarities and differences in professional roles, values and priorities as students focused on identifying patient centered priorities and meeting their individual needs within the context of social determinants of health. Most importantly, facilitators were encouraged to ensure students were communicating with students from other professions with mutual respect (Hitchcock et al., 2020). Further information about the development of the program and improvements over time can be found in Hitchcock et al., 2020.

The original IPTT design was held in-person for a decade, until the COVID-19 pandemic began in March 2020. Increased demand for IPTT sessions had led to expansion of the program to include Spring, Summer, and Fall semesters. The importance of in-person contact with students from other professions was considered pre-requisite to achieving learning objectives. However, restrictions associated with the COVID-19 pandemic precipitated an unplanned and sudden switch to online-only format using video conferencing. Hence, program evaluation was undertaken to compare student experiences of IPTT online with in-person instruction, specifically to compare learning experiences of students from different professional programs, to identify areas for quality improvement, and ultimately to assist in decision making about future delivery of IPTT post-COVID-19.

### Objective

This article presents an evaluation of in-person and online delivery modes for interprofessional team-based education and compares learner experiences across different health professions.

## Materials and methods

### Participants

Between Spring 2020 and Fall 2021, 2236 students participated in the IPTT experience as part of their course requirements as designated by their program directors. A total of 414 participated in-person during Spring 2020 and 1822 participated online from Summer 2020 onwards. A total of 59 facilitators participated in providing group facilitation for 159 total groups across six cohorts. Students represented the professions of clinical laboratory sciences, dentistry, medicine, nursing (RN-BSN; pre-licensure BSN; MSN), nutrition, occupational therapy, optometry, pharmacy, physical therapy, physician assistant, public health, respiratory therapy and social work. The majority of students were graduate level, having achieved undergraduate degrees prior to their health professions education.

### Methods

Student preparation: Prior to the COVID-19 pandemic, students were assigned to groups one week prior to the IPTT session and sent pre-event instructions by email. This package included information about the classroom location and group assignment. After the onset of the pandemic students participating in the online experience were sent details about how to join the event online, including their video conferencing classroom link.

Facilitator preparation: Prior to COVID-19, one week prior to the IPTT session, facilitators were sent a package of information by email to confirm arrangements and prepare for the event. They were invited to attend a just-in-time 'lunch and learn' in-person training session on the day of the event. In contrast, to prepare for the online event, multiple sessions were scheduled to train facilitators in the new online process via video conferencing. Most facilitators had previously participated in-person during previous years and therefore were familiar with the objectives of IPTT and patient cases. However, it was evident that not all facilitators were comfortable using video conferencing technology to run their group session. To further support facilitators, a teaching partner was provided to run the video conferencing technology (including breakout rooms), monitor student engagement and assist with general logistics.

Fig. 1 provides an outline of the process and steps for both IPTT in-person and online formats. The objectives of IPTT were consistent across delivery modes. The online adaptation centered on using video conferencing technology rather than physical space for teamwork activities. Facilitators ensured that students were visually present via webcam and audio systems (students muted microphones when not speaking) and movement between smaller group work (4–5 students) and larger group discussions (approximately 15 students) was facilitated through pre-assigned breakout rooms. While not every profession was represented in each breakout room, all professions were represented in the larger group. Given the facilitator was not physically present and could not visualize teamwork activities, the facilitator visited each break-out room at least once to promote discussion within the group or answer questions if needed. Students were also able to ask questions or be sent directions via the chat facility.

### Materials

At the conclusion of the IPTT session students were asked to reflect on their experience. A survey link was sent to students immediately after the event to capture post-training perceptions about interprofessional teamwork and feedback on the event. Students were given the option to opt out of having responses used in published reports. Responses from participants who opted out were included in internal quality improvement review only and are not included in this analysis. Ethical approval was granted with exemption for evaluation of educational practices

| Preparation 1 week prior (via email) | Step 1 Introduction 10 minutes | Step 2 Patient Story 20 minutes | Step 3 Teamwork 30 minutes | Step 4 Presentation 20 minutes | Step 5 Reflect and debrief 10 minutes |
|---|---|---|---|---|---|
| **Students** 1. Instructions to create elevator pitch for profession 2. Video Conference link **Facilitators** 1.Instruction package 2. Class list 3. Just in time training details 4. Video Conference link | **Facilitators [Main VC room]** Introductions Agenda overview **Student Teams [VC Breakout rooms]** Team introductions Elevator Pitch **Student Teams [Main VC room]** Discuss new insights/lessons learned about different professions | **Students [Main VC room]** View patient story video together then identify individual profession's key patient problems **Students [Main VC room]** Discuss immediate patient problems + additional information needed to assess; reflect, compare and contrast profession roles/priorities | **Student Teams [VC Breakout rooms]** Prioritize patient problems and develop IP care plan | **Student Teams [Main VC room]** Presentation of team care plans and key patient goals Compare and contrast different team plans. | **Students [Main VC room]** Debrief, reflect on roles and other professions; each share "key take away messages" Complete survey [QR code] Students emailed survey link |

**Fig. 1.** Interprofessional team training steps.
*Notes: During in-person IPTT students physically move between large group spaces ($n = 15$) to small group ($n = 3–4$) spaces for team-based activities. VC = video conferencing. IP = interprofessional.

(IRB: #300000478 University of Alabama at Birmingham).

The revised Interprofessional Collaborative Competency Attainment Scale (ICCAS) (MacDonald et al., 2010; Schmitz et al., 2017) self-assessment instrument was used to assess learner perceptions of ability to operate in an interprofessional team. This 20-item instrument comprises six domains reflecting interprofessional behavioral competencies including *communication, collaboration, roles and responsibilities, patient and family centered care, conflict management/resolution and team functioning,* (Schmitz et al., 2017). The reflective pre-and/post activity methodology requires responses to behavioral statements about interprofessional collaboration using a 5-point Likert Scale (1 = "Poor"; 2 = "Fair"; 3 = "Good"; 4 = "Very good"; 5 = "Excellent"). Score means can be calculated for individual items, domain and total score (all 20 items). Validation studies have demonstrated its effectiveness as an instrument for measuring perceived changes in learner efficacy after completing IPE activities (Schmitz et al., 2017).

### Analysis

Analyses of quantitative survey data were conducted using IBM SPSS Statistical Software (Version No. 26). Bivariate analyses were conducted to generate means and changes for ICCAS outcome variables for each profession, using paired samples *t*-tests and one way analysis of variance (ANOVA). Analyses used an alpha level of 0.05 for all tests to infer statistical significance. Cohen's D scores were calculated as measures of effect size. Multivariate General Linear Modelling (GLM) analyses (a form of regression analysis) were also employed, in order to assess robustness of univariate results by controlling for other factors. Several different GLM models were estimated to allow for deterministic relationships between some covariates. Specifically, all students in each profession were assigned to one and only one of the course stage groups (early/mid/late), while all students in a given cohort received one and only one of the mode of course delivery options (in-person/online).

### Results

#### Participant characteristics

Between Spring 2020 and Fall 2021, of the 2236 students who participated in the IPTT experience, 2086 (93.3 %) students completed and returned the ICCAS survey. A total of 1785 student responses were included in the analysis after excluding survey responses from 301 students who did not wish to be included in published reports (Table 1).

Professions represented in the greatest numbers were nursing (22.0 %), medicine (16.6 %), pharmacy (12.0 %) and dentistry (10.8 %). Across the six cohorts of IPTT a total of 59 facilitators gave of their time at least once to run IPTT sessions. In total these 59 persons provided 151 occasions of IPTT and conducted 304 IPTT sessions for 159 student groups. Most groups had at least two facilitators, with a small number having an additional facilitator trainee. By cohort, the number of facilitators ranged from a low of four (Summer 2020) to a high of 35 (Spring

**Table 1**
Student participants in IPTT by profession and IPTT session format.

| Profession | In-person $n = 407$ n (%) | Online $n = 1378$ n (%) | Total[a] $n = 1785$ n (%) |
|---|---|---|---|
| Clinical lab sciences | 15 (3.8) | 15 (1.1) | 30 (1.7) |
| Dentistry | 73 (18.3) | 115 (8.5) | 188 (10.8) |
| Medicine | 83 (20.8) | 207 (15.3) | 290 (16.6) |
| Nursing | 56 (14.0) | 328 (24.3) | 384 (22.0) |
| Nutrition | 12 (3.0) | 54 (4.0) | 66 (3.8) |
| Occupational therapy | 30 (7.5) | 103 (7.6) | 133 (7.6) |
| Optometry | 0 (0.0) | 29 (2.1) | 29 (1.7) |
| Pharmacy | 63 (15.8) | 146 (10.8) | 209 (12.0) |
| Physical therapy | 26 (6.5) | 58 (4.3) | 84 (4.8) |
| Physician assistant | 0 (0.0) | 109 (8.1) | 109 (6.2) |
| Public health | 0 (0.0) | 102 (7.6) | 102 (5.8) |
| Respiratory therapy | 0 (0.0) | 24 (1.8) | 24 (1.4) |
| Social work | 41 (10.3) | 59 (4.4) | 100 (5.7) |
| Total | 399 (100.0) | 1349 (100.0) | 1748 (100.0) |
| Missing data on profession | 8 | 29 | 37 |

[a] Participants include only those who gave permission for inclusion of their responses.

2020). All 13 professions provided facilitators on at least one occasion. The most highly represented professions were nursing (51 facilitator occasions, or 33.8 %), pharmacy (21.9 %) and medicine (9.3 %). In addition, the Office of Interprofessional Curriculum (OIPC) provided 19 facilitator occasions (12.6 %).

### ICCAS scores

Table 2 summarizes results from the administration of the ICCAS survey tool capturing student perceptions before and after IPTT for all participants. All increases in mean scores reported were statistically significant at $p < 0.0001$, indicating significant perceived learning both in total and across all ICCAS domains. A general guideline that is often employed is that a Cohen's D score of $>0.8$ is considered to denote a "large" effect of the intervention (Cohen, 1988). IPTT appears to have had a very large effect on student perceptions of learning in interprofessional collaborative behavior for all cohorts. Cohen's D scores for each ICCAS domain were in the range of 1.02 to 1.34, with an overall 20-item score of 1.43.

Although pre-IPTT ICCAS domain mean scores ranged from 3.42 to 3.73, there is relatively little variation overall across domains. The one exception was that students seemed to rate their "Conflict Management" skills more highly than other skills prior to IPTT (although this was not the case after IPTT). There is even less variation across domains in post-IPTT mean scores (4.18–4.28). Results thus suggest that it is appropriate to focus on Total 20 Item ICCAS scores in this analysis, as they appear to be representative of domain scores as well.

Table 3 summarizes mean 20-item ICCAS scores by gender, age group, cohort, delivery mode, profession and stage of course. There was a small but statistically significant ($p < 0.05$) difference in mean score change by gender, with females reporting slightly higher post-IPTT increases in scores on average (0.71 versus 0.63 for males). Both genders reported very large IPTT effects according to Cohen's D scores. Multivariate analyses suggest that these IPTT effects by gender are less significant after controlling for variations in profession and cohort ($p = 0.113$). There were no significant differences in ICCAS scores by age group, although the oldest group (age 40+) reported a larger increase. However, it should be noted that this group was quite small (<50 students across all six cohorts). All age groups reported very large IPTT effects according to Cohen's D scores. General Linear Models analysis confirmed that no strong link appears to exist between IPTT effects on ICCAS scores and age group ($p = 0.828$).

### Differences by cohort and IPTT format (in-person vs online)

There were significant differences in both pre and post IPTT ICCAS total mean scores across cohorts, as well as in change in mean score. In terms of ICCAS mean total score change, the Spring 2020 cohort (in-person), which recorded the highest mean change (0.79, with a Cohen's D of 2.03) was statistically significantly higher than all online cohorts. This suggests that mode of delivery may influence the size of ICCAS mean total score increase. Note, however, that all online cohorts also experienced large increases in mean total ICCAS score, as evidenced by Cohen's D statistics ranging from 1.00 to 1.57. This is confirmed when differences in mean total ICCAS score increase are compared for the in-person versus all online groups. The mean increase of 0.79 is statistically larger than the mean increase of 0.66 for the online groups combined. The effects of Cohort on ICCAS score change after IPTT remained after controlling for other covariates such as gender, profession and stage of course ($p < 0.001$).

### Differences by health profession

Overall, there were statistically significant differences in ICCAS mean total scores across professions before IPTT, after IPTT and for mean change in score. It is important to note that respiratory therapy ($n = 24$), optometry ($n = 29$) and clinical laboratory services ($n = 30$) are least well represented and results for these professions should be treated cautiously. Prior to IPTT, respiratory therapy students scored highest and the mean total ICCAS score of 4.03 was statistically higher than all other professions except pharmacy. The profession with the lowest pre-IPTT score, occupational therapy, was significantly lower than the five highest scoring professions but not statistically lower than the other seven professions. After IPTT, respiratory therapy students still scored highest on the ICCAS instrument, being statistically higher than the lowest-scoring eight professions. Medical students returned the lowest post-IPTT average total score, being statistically lower than the six top scoring professions. The largest increase in ICCAS scores was for Public Health students (0.89) and the lowest was for Respiratory Therapy students (0.52). However, all professions recorded large to very large ICCAS score increases, as evidenced by Cohen's D values in the range 0.76–2.20. The above effects were found to remain after controlling for other covariates such as gender, age, cohort and stage of course ($p = 0.001$).

### Stage of course

It was hypothesized that students may perceive different levels of confidence in their interprofessional skills according to the stage of their course progression. For example, students towards the end of their course may have had more opportunity to work with other professions during clinical placements. This is consistent with the results of pre-IPTT ICCAS scores, which increase with stage of course. The differences suggested by stage of course seem to remain after IPTT, as later stage students scored highest on both post-IPTT scores and change in score ($p = 0.044$). However, Cohen's D statistics demonstrate that IPTT led to very large increases in mean total ICCAS scores for all three groups in this comparison, though it is possible that students perceive more benefit when IPTT occurs later in course progression. Once other factors were controlled for via General Linear Modelling (GLM), the significance of the effect of course stage was reduced ($p = 0.157$).

### Discussion

In response to the COVID-19 pandemic in 2020, an unexpected and sudden switch from in-person interprofessional team training (IPTT) to a distance-accessible (online) IPTT was essential for sustaining IPE events at our institution. As the opportunity to return to in-person education increases, it is important to evaluate and compare the new distance accessible online format with in-person format to guide decisions about future delivery models for large interprofessional team training events.

Overall responses from students who participated in IPTT confirmed that objectives were achieved when it is delivered with either an in-person or online experience, with positive and statistically significant

**Table 2**
Mean score before & after IPTT plus mean score change, by domain & total all 20 items ($n = 1785$[a]).

| Domain | Before IPTT (SD) | After IPTT (SD) | Change (SD) | Cohen's D |
|---|---|---|---|---|
| Communication | 3.58 (0.79) | 4.17 (0.65) | 0.59 (0.59) | 1.13 |
| Collaboration | 3.43 (0.91) | 4.23 (0.67) | 0.81 (0.75) | 1.25 |
| Roles, responsibilities | 3.47 (0.85) | 4.23 (0.64) | 0.76 (0.65) | 1.34 |
| Patient centered | 3.47 (0.87) | 4.23 (0.68) | 0.76 (0.70) | 1.22 |
| Conflict management | 3.73 (0.80) | 4.28 (0.66) | 0.54 (0.61) | 1.02 |
| Team function | 3.42 (0.92) | 4.18 (0.72) | 0.76 (0.75) | 1.11 |
| All 20 items | 3.52 (0.77) | 4.22 (0.62) | 0.69 (0.59) | 1.43 |

[a] Missing Data on ICCAS Domain and Total Scores ranged from 125 to 188 Students across ICCAS measures due to missing responses to individual ICCAS items.

**Table 3**
Mean ICCAS score by participant characteristics, IPTT delivery format and profession.

| Characteristic | Before IPTT (SD) | After IPTT (SD) | Change (SD) | *p* value for change | GLM p value for change | Cohen's D |
|---|---|---|---|---|---|---|
| Gender | | | | **0.027** | 0.113 | |
|   Female | 3.52 (0.78) | 4.23 (0.62) | 0.71 (0.59) | | | 1.43 |
|   Male | 3.53 (0.74) | 4.16 (0.61) | 0.63 (0.57) | | | 1.37 |
| Age group | | | | 0.352 | 0.828 | |
|   <30 | 3.53 (0.77) | 4.21 (0.62) | 0.69 (0.59) | | | 1.39 |
|   30–39 | 3.47 (0.77) | 4.18 (0.63) | 0.70 (0.56) | | | 1.43 |
|   40+ | 3.39 (0.77) | 4.26 (0.57) | 0.81 (0.68) | | | 1.90 |
| Cohort | | | | **0.001** | **0.001** | |
|   In-person | | | | | | |
|     Spring 2020 | 3.62 (0.72) | 4.43 (0.53) | 0.79 (0.52) | | | 2.03 |
|   Online | | | | | | |
|     Summer 2020 | 3.57 (0.72) | 4.24 (0.58) | 0.68 (0.53) | | | 1.57 |
|     Fall 2020 | 3.41 (0.80) | 3.98 (0.71) | 0.57 (0.74) | | | 1.00 |
|     Spring 2021 | 3.43 (0.79) | 4.11 (0.59) | 0.70 (0.58) | | | 1.40 |
|     Summer 2021 | 3.59 (0.80) | 4.27 (0.59) | 0.69 (0.61) | | | 1.38 |
|     Fall 2021 | 3.50 (0.78) | 4.15 (0.64) | 0.65 (0.56) | | | 1.28 |
| IPTT format | | | | **<0.001** | **<0.001** | |
|   In person | 3.62 (0.72) | 4.43 (0.53) | 0.79 (0.52) | | | 2.03 |
|   Online | 3.49 (0.78) | 4.15 (0.63) | 0.66 (0.60) | | | 1.31 |
| Profession | | | | **0.001** | **0.001** | |
|   Clin lab serv | 3.43 (0.72) | 4.05 (0.68) | 0.65 (0.45) | | | 1.26 |
|   Dentistry | 3.55 (0.82) | 4.27 (0.69) | 0.69 (0.60) | | | 1.25 |
|   Medicine | 3.36 (0.68) | 3.97 (0.63) | 0.61 (0.63) | | | 1.42 |
|   Nursing | 3.67 (0.76) | 4.36 (0.57) | 0.70 (0.59) | | | 1.53 |
|   Nutrition | 3.31 (0.69) | 4.11 (0.50) | 0.80 (0.55) | | | 2.20 |
|   Occ. therapy | 3.27 (0.67) | 4.01 (0.55) | 0.75 (0.48) | | | 1.97 |
|   Optometry | 3.40 (0.90) | 4.11 (0.77) | 0.71 (0.66) | | | 1.01 |
|   Pharmacy | 3.81 (0.79) | 4.41 (0.56) | 0.60 (0.54) | | | 1.28 |
|   Phys. therapy | 3.29 (0.70) | 4.10 (0.56) | 0.78 (0.55) | | | 2.02 |
|   Physic. asst | 3.45 (0.73) | 4.07 (0.55) | 0.64 (0.44) | | | 1.48 |
|   Public health | 3.37 (0.74) | 4.25 (0.56) | 0.89 (0.59) | | | 2.04 |
|   Respiratory therapy | 4.03 (0.94) | 4.52 (0.64) | 0.52 (0.65) | | | 0.76 |
|   Social work | 3.60 (0.80) | 4.45 (0.56) | 0.83 (0.69) | | | 1.78 |
| Course stage | | | | **0.044** | 0.157 | |
|   Early | 3.44 (0.74) | 4.08 (0.65) | 0.64 (0.59) | | | 1.32 |
|   Middle | 3.54 (0.79) | 4.25 (0.60) | 0.71 (0.57) | | | 1.44 |
|   Late | 3.61 (0.76) | 4.34 (0.57) | 0.73 (0.60) | | | 1.62 |

*Notes: GLM = General Linear Modelling. Bold font indicates statistical significance at *p* < 0.05.

increases in ICCAS scores. Improvement in mean ICCAS scores for in-person delivery was 0.79 and 0.66 for online delivery, both with strong effect (Cohen's D 2.03 and 1.31 respectively). However, it must be acknowledged that there were greater score improvements reported for the in-person IPTT format with a statistically significant difference in size of effect observed between the two formats (*p* < 0.001). It is unclear whether this difference reflects important educational benefits of running the IPTT event in-person, or whether the swift pivot to online learning environments in pandemic conditions is at play. Establishing communities of enquiry with meaningful discourse necessary for effective IPE (Khalili, 2020) could have been further challenged by new technology and physical distance. This was coupled with the complexity of bringing together learners from different health profession, with varied experiences and knowledge of healthcare, inherent biases and misconceptions about roles and responsibilities in the healthcare team (Khalili, 2020). Under these complex circumstances perhaps it is not surprising that students participating in-person prior to the pandemic reported a somewhat larger improvement in scores when compared with students participating online.

In addition, even though most students reported improved self-assessed interprofessional learning outcomes, there were statistically significant differences in ICCAS scores for learners of different health professions, with some reporting greater change than others. This difference in perceived interprofessional learning by type of profession is a potentially important finding. In a previous evaluation of IPTT (in-person format) (Hitchcock et al., 2020) social work students reported greater perceptions of benefit from the experience. In this current evaluation, public health students, along with social work students,

reported higher change in scores related to perceptions of interprofessional learning (0.89 and 0.83 respectively). Profession differences in student perceptions of the impact of IPE activities have been explored in a variety of contexts (DelNero & Vyas, 2021; González Blum et al., 2022) with some studies suggesting that there are potentially important differences in the ways students of different professions perceive themselves and their professions role in the healthcare team before and after IPE activities. It is unclear from the literature how much influence learner experience in their profession prior to engagement in IPE has on learner outcomes, and whether it should influence program implementation beyond pragmatic issues. Timing of the IPTT activity according to program curriculum was a proxy for professional category in our evaluation and observed differences in learner experience by profession suggest future investigation in warranted. There is potential value for planners of IPE to determine whether there is optimal placement within their curriculum for delivery of IPE experiences within the learning continuum for different health professions.

From a logistics perspective, when compared with in-person IPTT, the attributes of distance-accessible online IPTT allowed greater flexibility in scheduling, increased number of training opportunities, and eliminated the geographical limitations of in-person training. This further expanded participation from students and facilitators. Use of smaller, more intimate "break-out rooms" in the online environment promoted greater contact, interaction and discussion among students who were better able to share and understand the similarities and differences of the professions represented in the room. The use of break-out rooms also increased efficiency when moving students from a larger group into smaller group activities compared with in-person sessions

where physical movement of students was a significant logistic challenge.

Researchers of online interprofessional education prior to COVID-19 reported technological challenges associated with synchronous online IPE, with examples of student difficulties in joining sessions (log-in problems), unreliable internet connections (students dropping out of the meeting space), and problems with digital devices (headphone/microphone malfunction) (Evans et al., 2014). Similar problems were experienced by IPTT facilitators, with additional problems reported with students not able to utilize web-cams to ensure visual engagement, and students dropping in and out of breakout rooms on multiple occasions, disrupting the flow of team-based learning. These problems were less frequent over time as students and facilitators became accustomed to using online classroom technology. However, reported benefits of online IPE such as enabling programs to widen participation of IPE for students in distance programs and increasing engagement with a larger number of professions (Sy et al., 2022), may outweigh some of these intermittent technological challenges. To overcome these challenges to provide seamless distance accessible IPTT, at least initially, greater organizational and technical support, along with increased facilitator technical training was needed for managing the video conferencing platform when compared with in-person meetings. Two facilitators were required for each IPTT session, increasing numbers of facilitators needed to support the event. The importance of facilitator focus on the social and cognitive presence, to promote student interaction and socialization to gain meaning from interprofessional learning (Khalili, 2020), was an important consideration for supporting this transition to an online environment. Providing the additional technological support allowed facilitators to focus on the learning process rather than the mechanics of the session. Over time, as facilitators become more comfortable with running video conferencing sessions, some were comfortable managing sessions without additional support. The use of a distance-accessible video conferencing platform ultimately provided greater efficiency for IPTT. Acknowledging the tradeoff between the benefits of in-person interprofessional learning with logistic efficiency, it may be feasible to provide both options in the future.

*Limitations*

It was not possible to ensure consistency in professional mix of students within each student group or across cohorts. The timing of student participation within their program of study was directed by individual health profession programs. This meant that numbers of students from each profession varied across the cohorts and within each IPTT group experience. During the pandemic some professions increased participation while others decreased participation. Facilitators also served as volunteers for IPTT and came from a variety of professions, and the mix of professions serving as facilitators varied across different cohorts. Assignment of students and facilitators to groups was essentially random. Most facilitators had participated in numerous IPTT sessions although participation varied from only one semester to all semesters. The extent to which any of these factors influenced the performance of in-person and online delivery is unclear.

*Implications for nursing and health professions education*

This evaluation highlights the potential educational value of online IPE activities involving large numbers of students from a variety of professions while simultaneously overcoming traditional institutional and logistical barriers. Online IPE presents new opportunities for institutions of higher education previously unable to implement and sustain IPE due to lack of necessary resources including in-person venues, access to other professional schools and distance programs. Online delivery provides new avenues for nursing and health professions to create innovative collaborations across professional programs and institutions, and to broaden access to include international students and global

health perspectives.

**Conclusion**

IPTT provides a valuable tool which allows learners from multiple professions to interact with one another to develop an appreciation for the contribution that other professions add to the care of patients. While in-person IPTT is shown to result in slightly higher ICCAS scores of student self-assessment, distance accessible IPTT also provides significant improvement in ICCAS scores with the benefit of greater efficiency, logistical flexibility in scheduling, numbers of students participating in IPTT, and facilitator involvement. Having both in-person and distance-accessible learning models available may support different learning styles and support student success in IPTT.

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**Declaration of competing interest**

All Authors have no financial or other interests to declare.

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