



The impact of course design features, gender, and academic level on student attitudes towards “Introduction to IPE” course: Mixed-methods analysis

Der Einfluss von Kursgestaltung, Geschlecht und akademischem Niveau auf die Einstellungen der Studierenden zum Kurs „Einführung in IPE: Mixed-Methods-Analyse”

Chamipa Phanudulkitti^{1*}, Debra Mattison², Vinoothna Bavireddy³,
Laura J. Smith⁴, M. Melissa Gross⁵

¹Burapha University, Faculty of Pharmaceutical Sciences,
20131, Chon Buri, Thailand
*chamipa@go.buu.ac.th

²University of Michigan, School of Social Work, 48109,
Ann Arbor, MI, United States

³University of Michigan, Center for Interprofessional
Education, 48109, Ann Arbor, MI, United States

⁴University of Michigan-Flint, Department of Physical Therapy,
48502, Flint, MI, United States

⁵University of Michigan, School of Kinesiology,
University of Michigan, 48109, Ann Arbor, MI, United States

Received 8 October 2023, accepted 13 March 2024

Abstract

Introduction. Interprofessional education (IPE) has been increasingly emphasized as a potential factor in high-quality health care. Despite a rising trend in online IPE courses, less attention has been given to how interactional formats intersect with learner characteristics. This study was to examine the impact of the introductory IPE online course on student attitudes about IPE and identify students' perceived value of specific instructional course components, such as Student–Student (SS) and Student–Content (SC) aspects, with respect to different academic levels and gender.

Methods. A mixed-methods design was used and involved quantitative data about the attitudes measured by the SPICE-R2 survey and qualitative open-ended questions about students' opinions. Participants completed the pre- and post-survey, before and after completing an online course.

Results. 2,373 students completed the online course and consented to have their responses in this analysis. The two-way ANOVA showed significant effects of academic levels on all three subdomains (Roles, Teamwork, and Outcomes; all $p < 0.001$), highlighting varied gains across levels, and the qualitative data were confirmatory or confirmatory plus expansive. Students preferred SC more than SS interaction.

Conclusion. This online course was an effective learning activity for improving students' attitudes toward IPE. Learning components focusing on real-life patient experience was the most valued and thus impactful course component. Mixed method findings highlighted important awareness of the impact of learner characteristics on the perceived value of course components. Tailoring IPE course content and delivery to meet diverse learners' learning needs and expectations would be more impactful.

Abstract

Einleitung: Interprofessionelle Ausbildung (IPE) wird zunehmend als wichtiger Faktor für eine qualitativ hochwertige Gesundheitsversorgung angesehen. Obwohl Online-IPE-Kurse immer beliebter werden, wurde dem Zusammenspiel von Interaktionsformaten und Lernendenmerkmalen bisher wenig Aufmerksamkeit geschenkt. Diese Studie untersuchte die Auswirkungen eines einführenden IPE-Online-Kurses auf die Einstellung der Studierenden zu IPE und identifizierte den wahrgenommenen Wert spezifischer Unterrichtskomponenten (Student-Student (SS) und Student-Content (SC)) in Bezug auf verschiedene Studienniveaus und das Geschlecht.

Methoden: Es wurde ein Mixed-Methods-Design verwendet, das quantitative Daten zu den mit der SPICE-R2-Umfrage gemessenen Einstellungen und qualitative offene Fragen zu den Meinungen der Studierenden umfasste. Die Teilnehmerinnen und Teilnehmer füllten die Vor- und Nachbefragung vor und nach Abschluss des Online-Kurses aus.

Ergebnisse: 2.373 Studierende absolvierten den Online-Kurs und erklärten sich mit der Verwendung ihrer Antworten in dieser Analyse einverstanden. Die Zwei-Wege-ANOVA zeigte signifikante Effekte des Studienniveaus auf alle drei Subdimensionen (Rollen, Teamarbeit und Ergebnisse; alle $p < 0,001$), was auf unterschiedliche Zuwächse auf verschiedenen Ebenen hindeutet. Die qualitativen Daten waren bestätigend oder bestätigend und erweiternd. Die Studierenden bevorzugten die SC-Interaktion gegenüber der SS-Interaktion.

Schlussfolgerung: Dieser Online-Kurs war eine effektive Lernmethode zur Verbesserung der Einstellung der Studierenden gegenüber IPE. Lernkomponenten, die sich auf reale Patientenerfahrungen konzentrierten, waren die am meisten geschätzte und damit wirkungsvollste Komponente des Kurses. Die Ergebnisse der Mixed-Methods-Studie unterstreichen die Wichtigkeit des Bewusstseins für den Einfluss der Lernendenmerkmale auf den wahrgenommenen Wert von Kursgestaltung. Eine Anpassung der Inhalte und der Durchführung von IPE-Kursen an die Bedürfnisse und Erwartungen verschiedener Lernender wäre wirkungsvoller.

Keywords

interprofessional education – attitudes – mixed-methods research

Keywords

Interprofessionelle Ausbildung – Einstellungen – Mixed-Methods-Forschung



INTRODUCTION

Interprofessional education (IPE) and interprofessional education and collaborative practice (IPECP) have been increasingly emphasized as a potential key factor in high-quality and patient-family centered health care delivery (Ateah et al., 2011). IPE is also valued for its potential to prepare students for collaborative practice and promotion of the quadruple aim of improving population health, improving the patient experience of care, reducing the per capita cost and improving provider satisfaction and wellness (Cox et al., 2017; National Center for Interprofessional Practice and Education).

A primary goal of introductory IPE offerings is to support health professional students in gaining foundational knowledge about IPE and developing an appreciation for their own and other professions by learning about it from and with students across disciplines (Gross et al., 2022; Guraya & Barr, 2018). Thus, offering an introductory IPE course at an early stage of health professionals' education is often seen as beneficial (Coster et al., 2008; Guraya & Barr, 2018). Introductory IPE experiences have been offered with a variety of pedagogical approaches in both in-person and online formats (Beard et al., 2015; Shaw-Battista et al., 2015; Smith et al., 2019). Generally, both formats are evaluated positively by learners while also producing expected results in learning outcomes including a positive impact on interdisciplinary collaboration and teamwork, reduction in preconceptions of other healthcare disciplines and promotion of professional competencies (Al-Qahtani, 2016; Barr & Ross, 2006; Cusack & O'Donoghue, 2012; Gross et al., 2022). Recent studies point to an increasing trend in offering IPE courses in online formats (Jones et al., 2020; Khalili, 2020; Poirier et al., 2016; Singh & Matthees, 2021), yet there has been less attention regarding how specific types of learning and interactional formats intersect with a variety of learner characteristics and thus impact learning outcomes.

In a meta-analysis exploring similarities and differences between face-to-face classroom learning and distance learning, Bernard et al. (2009) noted that "Instructional designs that foster higher quality interactions focus on course features that promote high-quality learning activities" (p. 1266). The authors identified three general types of "interaction treatments" (ITs): 1. Student-Student (SS) interaction, 2. Student-Teacher (ST) interaction, and 3. Student-Content (SC) interaction. SS interaction refers to interaction among individual students or among students working in small groups. These interactions can be synchronous, as in videoconferencing and chatting, or asynchronous, as in discussion boards or e-mail messages. ST interaction focuses on classroom-based dialogue between students and the instructor. ST interaction may be

also expanded to online-based formats with synchronous student-instructor interaction such as telephone calls, videoconferencing, and chats, or asynchronous through correspondence, e-mail, and discussion boards. SC interaction refers to students individually interacting with the subject matter. Some examples of SC interaction include reading informational texts, using study guides, watching videos, interacting with computer-based multimedia, using simulations, using cognitive support software (e.g., statistical software), as well as searching for information, completing assignments, and working on projects. Among these three interaction types in distance education, SS and SC interactions have been found to have a higher impact on students' achievements and attitude than ST interactions (Bernard et al., 2009).

Hallam et al. (2016) advocate for the necessity of attending to "the inherent diversity of students" rather than delivering "generic programs suited for the whole" (p. 8). Further exploration regarding the effectiveness of types of instructional design may inform effective instructional and interactional design of both the content and format of IPE courses to best meet the learning needs of diverse student learners.

The primary purpose of this study was to examine the impact of an introductory IPE experience using an existing instructional design framework exploring the impact of two types of interaction treatments on student attitudes about IPE: SC and SS. A secondary aim was to identify the impact of specific instructional course components on learners with respect to different academic levels and gender. A mixed-methods analysis was used to associate shifts in student attitudes about IPE with student perceptions of the value of different course components.

METHODS

Research design

A cohort design was used to evaluate the impact of student engagement types and course components in the online introductory IPE course ("Introduction to IPE") offered in two consecutive fall academic semesters. The analyses were approved by the University's Institutional Review Board (IRB), and all participants were provided with the option to have their data excluded from the analysis.

Research setting and participants

A total of 2,373 students in two cohorts (993 in Fall 2018 and 1,380 in Fall 2019) participated in the online IPE course. The students enrolled in health science or pre-health profession programs at the undergraduate or graduate level at each of three campuses of the University



of Michigan participated. Most students were in the first year of their programs. The participating programs are grouped by campuses as follows:

- Ann Arbor campus: Medicine, Dentistry, Kinesiology, Nursing, Pharmacy, Public Health, Social Work, Law, and the College of Literature, Science, and the Arts (LSA).
- Dearborn campus: College of Education, Health, and Human Services (EHHS).
- Flint campus: College of Health Sciences (including Physical Therapy and Respiratory Therapy).

Introduction to IPE online course

The online course was available to students for two weeks, typically as a required assignment embedded in another course. The online course was composed of six sequential modules administered in the University's learning management system (Canvas). Each module was designed to enable students to interact with each other (SS) or with the course materials (SC) (see Table 1). After

the course welcome module that included a pre-course survey, the next two modules presented information to students as videos with follow-up questions. The first video highlighted the personal narrative of a family member navigating the healthcare system in a complex case accompanied by a faculty overview of the healthcare system. The subsequent videos highlighted the benefits of IPE and interprofessional practice. In the next two modules, students interacted with other students by first posting a 6-word response to the following prompt, "As a future professional, how do you see yourself contributing to the health and well-being of people and populations?" and then commenting on the 6-word posts from students in different professions. The course wrapped up with information about other IPE opportunities at the University, and students were asked to complete a post-course survey and to evaluate the course. The online course has been described more fully in a previous publication (Gross et al., 2022).

Table 1: Relationship of course modules to interaction type and SPICE-R2 subdomain for each course module.

Course Component (CC)	CC description	SPICE-R2 Subdomain	Student Engagement Interaction Type	Post-Course Evaluation Question
n/a	Welcome/Pre-survey	n/a	n/a	n/a
1	Informational Video ("Where does it hurt?")—patient experience and healthcare system <i>Reflection questions</i>	Outcomes	Student–Content	The "Where Does It Hurt?" video helped me better understand the challenges with the current healthcare system.
2	Informational videos ("Interprofessional Education")—need for IPE <i>Quiz questions</i>	Teamwork	Student–Content	The "Interprofessional Education" videos increased my understanding of IPE and the IPE competencies.
3	Informational videos ("Interprofessional Education")—relation to quadruple aim <i>Quiz questions</i>	Teamwork	Student–Content	The "Interprofessional Education" videos demonstrated the value of participating in IPE to my future work as a health professional.
4	Discussion board prompt <i>Provide a 6-word message about own health profession</i>	Roles	Student–Student	Creating and browsing the "6-word messages" for my own profession helped me understand the unique contributions of my profession to the health and well-being of people and populations.
5	Discussion board prompt <i>Respond to messages about other health professions</i>	Roles	Student–Student	Browsing and commenting on "6-word messages" for other health professionals increased my understanding of their valuable contributions to the health and well-being of people and populations.
6	Information—IPE opportunities at the university <i>Indicate interest in IPE</i>	n/a	Student–Content	I know where to find more IPE opportunities at U-M.
n/a	Post-survey and evaluation questions	n/a	n/a	n/a



Data collection

The impact of the introductory IPE online course on student attitudes towards IPE was assessed using SPICE-R2 (Dominguez et al., 2015; Zorek et al., 2016). SPICE-R2 contains items related to the subdomains of IPE including interprofessional teamwork and team-based practice (three items), roles and responsibilities for collaborative practice (four items), and patient outcomes (three items) (Fusco & Foltz-Ramos, 2018; Theodorou et al., 2018). Content and activities in the course modules were aligned with the three subdomains of SPICE-R2 (Table 1). SPICE-R2 was administered in the pre- and post-course surveys using Qualtrics© software. Demographic information from student records was obtained with IRB-approved permissions.

Evaluation questions administered in the last module of the course were designed to assess student perceptions about the value of individual course components as well as the overall course. A 5-item Likert scale was used as the response format (strongly disagree, disagree, neutral, agree, strongly agree) for all of the evaluation questions, as detailed in Table 1, except for the last two that used an open-ended response format (“What was the most valuable part of this course” and “What recommendations would you make to increase the value of this course”). Responses for two questions (“I know where to find more IPE opportunities at U-M” and “I am likely to recommend this course to another student”) were not included in the analysis because they were beyond the scope of the current investigation.

Quantitative data analysis

A total of 2,373 participants who consented to participate in the online IPE course completed the SPICE-R2 survey two times, before (Time 1) and after (Time 2) participating in the course. The survey consisted of 10 items, three items for Roles, four items for Teamwork, and three items for Outcomes. The response format was a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The mean responses across students were calculated at Time 1 and Time 2. Gender and academic level were determined for each respondent using student record data obtained from the Registrar for each campus. Gender was coded as male or female, and the academic level was coded as undergraduate or graduate. The analysis of variance (ANOVA) was used to explore the effects of gender and academic level on SPICE-R2 scores before students completed the online course and on responses to the evaluation questions after students completed the online course. The significance level for all statistical analyses was set at $p < 0.05$. We used SPSS version 26 (SPSS Inc., Chicago, Illinois) to run the analyses.

Qualitative data analysis

There were 2,301 participants who consented and provided their responses to the open-ended questions. The qualitative data were analyzed using MAXQDA© software. The analysis involved several steps: (1) four authors (M.G., D.M., V.B., and C.P.) read through the participants’ responses several times to obtain a sense of the whole in relation to the research question; (2) a 10% random sample was selected and used an inductive (allows the data to determine the themes) latent (reading into the subtext and assumptions underlying the data) approach to examine data themes; (3) individual raters highlighted sections of student responses and defined labels or “codes” to describe emerging themes; (4) coding team combined and created revised codes and code criteria based on analyzed sample; (5) levels of agreement between coders were compared for the initial inter-rater reliability; and (6) a new random sample of 30% responses were selected and coded and achieved a kappa value of 0.95 with excellent agreement between the coders.

Mixed-methods analysis

A convergent mixed methods design involves quantitative and qualitative data collection and analysis at similar times, followed by an integrated analysis (Guetterman et al., 2015). The convergent design can be used to accentuate findings from both large-scale surveys with complementary qualitative data to gain a comprehensive understanding of participants’ attitude changes (Creswell & Plano Clark, 2017).

Quantitative data of this study included students’ attitude changes toward the online introductory IPE course measured by SPICE-R2. Qualitative data were obtained from the open-ended question about students’ attitudes about the most valuable part of the online course: “What was the most valuable part of this course?”. To integrate data collected from both quantitative and qualitative methods, the open-ended responses were aligned with the SPICE-R2 for each of the three subdomains (Roles, Teamwork, and Outcomes).

Joint display tables were created to present the quantitative and qualitative results with meta-inferences. The results from the two datasets were explicitly merged through a side-by-side comparison to assess confirmation, expansion, or discordance between the datasets and to draw meta-inferences. Confirmation occurred if the findings from both types of data reinforced the results from the other. Expansion occurred when the findings from the two datasets overlapped and additional insights of attitude changes were identified as different or complementary aspects of the changes. Discordance occurred if the data types were inconsistent, contradictory, or disagreed with each other (Fetters et al., 2013).



Table 2: Differences in SPICE-R2 scores before completing the online course (Time 1).

	Male		Female		Effects	F-statistic	p-value	η^2
	UG	G	UG	G				
Roles					GEN	1.26	0.261	0.00 ^a
	3.45 (0.7)	3.42 (0.72)	3.42 (0.68)	3.37 (0.67)	ACL	1.53	0.216	0.00 ^a
					Interaction	0.07	0.791	0.00 ^a
Teamwork					GEN	21.80	0.000*	0.01 ^a
	4.28 (0.56)	4.37 (0.53)	4.39 (0.52)	4.5 (0.49)	ACL	15.47	0.000*	0.01 ^a
					Interaction	0.28	0.596	0.00 ^a
Outcomes					GEN	23.05	0.000*	0.01 ^a
	3.83 (0.59)	4.01 (0.6)	3.98 (0.57)	4.13 (0.55)	ACL	32.72	0.000*	0.01 ^a
					Interaction	0.19	0.662	0.00 ^a

Note: Values are expressed as the mean (standard deviation). UG, undergraduate; G, graduate; GEN, gender; ACL, academic levels; *, statistical significance with $p < 0.05$; η^2 partial eta squared; a, small effect size.

RESULTS

Student demographics

Eighty percent ($n=2,373$) of the students who completed the online course in Fall 2018 and Fall 2019 ($n=2,949$) consented to have their responses included in this analysis. The majority of respondents were graduate students (52.2%) and identified as female (76%).

Student attitudes about IPE before completing the online course

Across subdomains, mean SPICE-R2 scores were near or exceeded the “Agree” level (4.0) indicating that students had a generally positive attitude about IPE before participating in the course. The mean subdomain scores for all students were highest for Teamwork (4.42 out of 5) and were lowest for Roles (3.40 out of 5). Gender and academic level had significant main effects on teamwork and outcomes: Females and graduate students rated both subdomains more positively than males and undergraduates (see Table 2). The effect size for the main effects was small ($\eta^2 = 0.01$). There was no statistically significant interaction between these factors ($p > 0.05$).

Changes in student attitudes about IPE after completing the online course

Post-course scores were significantly higher (more positive) than pre-course scores for Roles, Teams, and Outcomes for all student groups (all $p < 0.001$). The academic level had significant main effects on roles, teamwork, and outcomes, with undergraduate students rating all three subdomains more positively compared to graduates (see Table 3). This suggests that students at different academic levels may experience varied gains. However, their effect size for these differences was small

($\eta^2 = 0.01$). Notably, gender did not exert a significant main effect ($p > 0.05$) nor interact with academic level ($p > 0.05$).

Student perceptions about the value of individual course components and interaction types

Student perceptions regarding the value of SC learning formats were significantly higher than student perceptions about the value of SS learning formats ($p < 0.001$). Among all course components, the SC learning utilizing patient-experience video was rated with the highest scores (4.29 out of 5) whereas SS learning involving creating and browsing the “6-word messages” was rated with the lowest scores (3.98 out of 5).

Differences related to both gender and academic level were noted in students’ perceived value of course components. Gender and academic level had significant main effects on all course components. Females and undergraduate students rated all course components, particularly SC (videos) and SS (6-word activities), more positively than males and graduates (see Table 4). Their effect sizes were small ($\eta^2 = 0.01$). Notably, the analysis did not identify a statistically significant interaction effect between gender and academic level ($p > 0.05$), implying that the influence of course components on perceived value remained independent of the combined effect of gender and academic level.

Representative comments from males regarding SC components suggested brief, information focus on factual description of professional education, qualifications, and roles of each discipline. Male students voiced that SS components (6-work message and discussion boards) were not as helpful to them in understanding the role of other healthcare professionals’ specific roles in patient care and again preferred that examples of “real-world collaboration” between professions would be more beneficial. Overall, males tended to prefer SC over SS learning components.



Table 3: Mean differences in SPICE-R2 scores after completing the online course (Time 2).

	Male		Female		Effects	F-statistic	p-value	η^2
	UG	G	UG	G				
Roles					GEN	0.59	0.441	0.00 ^a
	0.56 (0.71)	0.41 (0.69)	0.59 (0.73)	0.44 (0.68)	ACL	17.36	0.000*	0.01 ^a
					Interaction	0.02	0.881	0.00 ^a
Teamwork					GEN	0.82	0.366	0.00 ^a
	0.27 (0.45)	0.2 (0.47)	0.32 (0.47)	0.19 (0.4)	ACL	19.15	0.000*	0.01 ^a
					Interaction	1.91	0.167	0.00 ^a
Outcomes					GEN	0.59	0.443	0.00 ^a
	0.55 (0.59)	0.39 (0.53)	0.54 (0.59)	0.44 (0.5)	ACL	22.01	0.000*	0.01 ^a
					Interaction	0.95	0.331	0.00 ^a

Note: Values are expressed as the mean (standard deviation). UG, undergraduate; G, graduate; GEN, gender; ACL, academic levels; *, statistical significance with $p < 0.05$; η^2 partial eta squared; a, small effect size.

Table 4: Perceptions of the course components (CC1-CC5) after completing the online course (Time 2).

	Male		Female		Effects	F-statistic	p-value	η^2
	UG	G	UG	G				
CC1					GEN	16.35	0.000*	0.01 ^a
	4.23 (0.71)	4.13 (0.75)	4.4 (0.65)	4.24 (0.69)	ACL	14.14	0.000*	0.01 ^a
					Interaction	0.59	0.442	0.00 ^a
CC2					GEN	11.90	0.001*	0.01 ^a
	4.18 (0.73)	4.03 (0.78)	4.29 (0.68)	4.17 (0.7)	ACL	15.40	0.000*	0.01 ^a
					Interaction	0.14	0.704	0.00 ^a
CC3					GEN	18.68	0.000*	0.01 ^a
	4.23 (0.68)	4.1 (0.72)	4.38 (0.6)	4.24 (0.68)	ACL	16.49	0.000*	0.01 ^a
					Interaction	0.00	0.959	0.00 ^a
CC4					GEN	14.43	0.000*	0.01 ^a
	3.92 (0.96)	3.76 (1.04)	4.16 (0.86)	3.88 (0.99)	ACL	20.76	0.000*	0.01 ^a
					Interaction	1.74	0.188	0.00 ^a
CC5					GEN	11.98	0.001*	0.01 ^a
	4.04 (0.91)	3.88 (1.03)	4.23 (0.8)	4.01 (0.93)	ACL	17.97	0.000*	0.01 ^a
					Interaction	0.50	0.481	0.00 ^a
CC1-CC3					GEN	21.37	0.000*	0.01 ^a
	4.22 (0.61)	4.09 (0.66)	4.36 (0.54)	4.22 (0.58)	ACL	21.17	0.000*	0.01 ^a
					Interaction	0.02	0.884	0.00 ^a
CC4-CC5					GEN	14.54	0.000*	0.01 ^a
	3.98 (0.89)	3.82 (0.98)	4.2 (0.79)	3.94 (0.91)	ACL	21.36	0.000*	0.01 ^a
					Interaction	1.14	0.286	0.00 ^a
CC1-CC5					GEN	23.19	0.000*	0.01 ^a
	4.12 (0.64)	3.98 (0.7)	4.29 (0.55)	4.11 (0.62)	ACL	27.59	0.000*	0.01 ^a
					Interaction	0.45	0.500	0.00 ^a

Note: Values are expressed as the mean (standard deviation). UG, undergraduate; G, graduate; GEN, gender; ACL, academic levels; *, statistical significance with $p < 0.05$; η^2 partial eta squared; a, small effect size; CC, Course Components were

CC1: "Where Does It Hurt?" video

Perception Question: The "Where Does It Hurt?" video helped me better understand the challenges with the current healthcare system.

CC2: "Interprofessional Education" video—IPE and IPE competencies

Perception Question: The "Interprofessional Education" videos increased my understanding of IPE and the IPE competencies.

CC3: "Interprofessional Education" video—the value of IPE to future work as a health professional

Perception Question: The "Interprofessional Education" videos demonstrated the value of participating in IPE to my future work as a health professional.

CC4: Creating and browsing the "6-word messages"

Perception Question: Creating and browsing the "6-word messages" for my own profession helped me understand the unique contributions of my profession to the health and well-being of people and populations.

CC5: Browsing and commenting on "6-word messages"

Perception Question: Browsing and commenting on "6-word messages" for other health professionals increased my understanding of their valuable contributions to the health and well-being of people and populations.

CC1-CC3: Student-Content Interaction Types

CC4-CC5: Student-Student Interaction Types

CC1-CC5: Comprehensive Course Components



Graduate students desired SC learning to be focused on patient-centered videos that provided more “real life” scenarios and illustrations of interprofessional collaboration in practice. Regarding SS learning, there was a desire for deeper cross-disciplinary interactions with suggestions to organize discussion prompts around social justice, research/innovation, technology, patient care, and social determinants of health to promote more engaged, free-flowing thoughts and discussions around common issues relevant to all health professions.

Relationship between changes in student attitudes about IPE and evaluation of course value

The results from the two datasets, changes in student attitudes about IPE (SPICE-R2) and student evaluations of course value, are presented as joint display tables. In the joint display tables, both quantitative and qualitative results are merged in a side-by-side comparison to develop meta-inferences, that is, to determine whether the qualitative data confirm (“confirmation”), expand (“expansion”) or conflict (“discordance”) with the quantitative data. Overall, we found the qualitative data were consistent with quantitative data (“confirmation”), and for some student groups and subdomains, the qualitative data demonstrated expanded learning outcomes beyond just confirmation (“expansion”).

For all three subdomains, the responses to qualitative data were consistent with the significant increase in SPICE-R2 scores after participation in the course supporting a meta-inference designation of “confirmation”. As there was no interaction effect observed between gender and academic levels, we created joint display tables to investigate variations in quantitative and qualitative data pertaining to gender (see [Table A1 in the appendix](#)) and academic levels (see [Table A2 in the appendix](#)). For the Teamwork subdomain, there was a meta-inference difference between genders and academic levels. Male students’ and graduate students’ responses demonstrated teamwork learning outcomes at an “expanded” level, that is, they expressed a deeper understanding of the impact of teamwork on patients’ well-being, outcomes, and patient care compared to the female students and undergraduate students. For the Outcomes subdomain, the meta-inference was similar for both genders, with students’ responses demonstrating an “expansion” of understanding, that is, both male and female students learned more about the U.S. health system.

DISCUSSION

Using a mixed-methods analysis, our findings analyzed shifts in student attitudes toward IPE as well as student perceptions of the value of different course

components. Evaluation of this online introductory IPE course supported two primary findings: (1) the course comprised of two interaction treatments, SC and SS, had a significant, positive impact on all students’ attitudes about IPE in all subdomains and (2) specific instructional course components were experienced and perceived differently among learners with respect to learners’ different academic levels and gender. Female students and undergraduate students reported higher perceptions of valuing all course components as well as the specific SC course components than male students and graduate students.

The online introductory IPE course had a significant, positive impact on all students’ attitudes toward IPE. Although student attitudes about IPE improved for all students in all subdomains, the greatest changes occurred for Roles. This finding may be related to students starting the course with attitudes toward Roles’ scores being the lowest among all of the subdomains, and thus had the most potential for improvement. Also, course activities offered multiple opportunities for students to learn more about other professional roles. In considering two independent variables, gender, and academic levels, along with their potential interaction effects on attitudes toward IPE, the data unveiled a noteworthy influence of academic levels on such attitudes. Specifically, undergraduate students demonstrated greater improvement in attitudes towards IPE than graduate students. This finding is consistent with previous studies showing younger (undergraduate) learners as more open to and willing to engage in new learning compared to older (graduate) learners (Anderson & Thorpe, 2008; Gross et al., 2022). However, improvement in attitudes does not necessarily predict a deeper level of understanding of IPE (Shah et al., 2019). While graduate students had less improvement in positive attitudes regarding IPE after the course compared to undergraduates, they reported deeper levels of understanding and application of IPE to their practice. Mixed methods analysis of the Teamwork subdomain showed that while undergraduate and graduate students reported “Confirmation” learning (agreement with IPE concepts), graduate students more often than undergraduate students expressed both “Confirmation” learning as well as “Expansion” learning (application of IPE Teamwork to their own practice). It is possible that graduate students have more exposure to interprofessional experiences and higher levels of critical thinking, and thus had more developed skills and knowledge resulting in their ability to link benefits of IPE Teamwork to patient outcomes (Sulaiman et al., 2012). Hayward et al. also noted that graduate students often prefer to learn quickly and prefer learning activities and content that has immediate and pragmatic application (2021). These academic level differences raise questions regarding the impact on learning of mixing graduate and undergraduate



students in IPE courses without attention to their different learning experiences, preparedness, and needs.

This online course was designed to enable students to interact with the course materials in one of two ways: SC and SS interactions. SC interaction activities were composed of watching videos with real-life scenarios and didactic information. SS interaction activities with each other included interaction on a discussion board regarding one's own and other professions. When comparing students' perceived value of SC activities to SS activities, the former was higher rated by all students. Among the SC components, the "real-life" scenario video was rated as having the highest value by all students. Grober et al. (2020) and Luke et al. (2009) supported this finding as IPE videos explicitly showing professionals from different professions and real-life examples demonstrate advantages such as evoking new perspectives for learners at all levels, fostering interprofessional collaboration in clinical practice, and being more engaging and illustrative of concepts. Bernard and colleagues noted that, besides SC and SS formats, ST formats are also available for fostering classroom interaction, but may be less effective and harder to implement consistently, and suggested that the quality of ST interactions could be improved by emphasizing comprehensive and higher order thinking skills, rather than lower-level information, procedural details, or assessment-related issues (Bernard et al., 2009). Other studies have supported the benefits of incorporating interactions between students and facilitators into some parts of the course (Evans et al., 2020; Khalili, 2020; Luke et al., 2009). This suggests SS learning may be enhanced by the addition of an instructor facilitating student interactions. Significant differences in responses to learning content were found based on learner gender and academic levels. Overall, female students had higher positive perceptions of the value of all course components than male students. Female students had higher perceptions of both SC course components and SS course components than male students. These findings are consistent with other studies suggesting that females prefer "connected" learning involving listening to the views and perspectives of others (Coster et al., 2008) and a focus on process-oriented interactions (Oever & Haans, 2020). Zhang and Yang noted that women communicated more, experienced higher social presence, and performed better than men in a web-based introductory information systems course or e-learning environment (Zhang & Yang, 2022). It is notable that an alternative was suggested by males in this course to replace SS learning discussion boards in which students exchange information about their disciplines with an informational short video presenting information on each profession. This suggests a preference by males for more

informational content-focused learning over collaboration process, as interactional team learning previously noted (Behrend et al., 2020; Bell et al., 2014; Lindh Falk et al., 2015; Wilhelmsson et al., 2011). These differences alert course designers to intentionally consider formats to deliver content and instructor skills to navigate potential gender-based preferences. Undergraduate students had higher perceptions of the value of all course components than graduate students. This aligns with research suggesting younger learners exhibit greater openness and engagement with new learning experiences compared to older learners (Anderson & Thorpe, 2008; Gross et al., 2022). Additionally, findings from a study conducted by Gonsar and colleagues indicated that undergraduate students expressed a keen interest in augmenting opportunities for collaborative activities outside of class with their peers (Gonsar et al., 2021). This suggests a potential avenue for enhancing their engagement and perceived value of the learning experience.

This study offers practical insights regarding an intentional focus on design and delivery of IPE courses with consideration of learner's gender and academic levels. Results suggest that learning elements focusing on real-life patient experience was the most valued and thus impactful course component. SC learning was preferred by students over SS learning suggesting the potential value of instructor facilitation to enhance SS interactions. The ANOVA results emphasized the pivotal role of academic levels in shaping attitudes toward IPE. Moreover, the mixed-method findings highlighted important awareness of the impact of learner characteristics (academic level and gender) on the perceived value of course components. Strengths of this study include a large data set from students who participated in the course, completed measurement instruments, and the representation of diverse professions. However, the study's limitations are notable, particularly the identification of small effect sizes, indicating minor differences with limited implications for educational practice or policy. Future investigations are advised to incorporate potentially impactful individual learner characteristics (i.e., personality, extraversion/introversion, emotional stability), learning styles, cultural preferences, and psychological factors. The study also had no control group to compare attitudes toward IPE of students with no exposure to IPE-focused courses. Gender findings are also limited due to binary male-female categories.

CONCLUSION

Both challenges and opportunities exist for IPE course development and implementation to further improve IPE learning experiences and outcomes. Our findings support



that while a “generic one size” approach may appear more efficient, it may not “fit all” nor be as effective as more tailored courses. Our online course demonstrated efficacy in improving overall attitudes toward IPE among all students. Moreover, implementing the IPE course during earlier stages of education (undergraduate) appeared to have a more pronounced impact on overall IPE attitudes. Additionally, our findings indicate that inherent differences of individual learners related to gender and academic level impact perceptions of and response to various delivery formats of IPE online course content. Thus, intentional consideration and tailoring of IPE course design and content delivery to meet diverse individual learners’ needs and expectations can inform more effective design of non-generic, specialized IPE experiences for a diverse range of students.

ACKNOWLEDGMENT

This work was supported by the University of Michigan Center for Interprofessional Education.

ETHICS APPROVAL

This study was reviewed under IRB-exempt determination (HUM00153157).

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conceptualization, M.G.; methodology, M.G. and C.P.; software, V.B.; formal analysis, C.P., V.B., D.B., and M.G.; data curation, C.P. and V.B.; writing—original draft preparation, C.P. and D.B.; writing—review and editing, L.S., D.B., M.G., V.B., and C.P.; supervision, M.G. All authors have read and agreed to the published version of the manuscript.

References

- 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/https://doi.org/10.1016/j.jtumed.2016.09.003>
- Anderson, E. S., & Thorpe, L. N. (2008). Early interprofessional interactions: does student age matter? *J Interprof Care*, 22(3), 263–282. <https://doi.org/10.1080/13561820802054689>
- Ateah, C. A., Snow, W., Wener, P., MacDonald, L., Metge, C., Davis, P., Fricke, M., Ludwig, S., & Anderson, J. (2011). Stereotyping as a barrier to collaboration: Does interprofessional education make a difference? *Nurse Educ Today*, 31(2), 208–213. <https://doi.org/10.1016/j.nedt.2010.06.004>
- Barr, H., & Ross, F. (2006). Mainstreaming interprofessional education in the United Kingdom: a position paper. *J Interprof Care*, 20(2), 96–104. <https://doi.org/10.1080/13561820600649771>
- Beard, T. S., Robertson, T. M., Semler, J. R., & Cude, C. J. (2015). A study of interprofessional collaboration in undergraduate medical laboratory science and nursing education. *American Society for Clinical Laboratory Science*, 28(2), 83–90. <https://doi.org/10.29074/ascls.28.2.83>
- Behrend, R., Czeskleba, A., Rollinger, T., Petzold, M., Roa Romero, Y., Raspe, R., Maaz, A., & Peters, H. (2020). Medical students’ ratings of the relevance and actual implementation of interprofessional education and preferences for teaching formats: comparison by gender and prior education. *GMS J Med Educ*, 37(2), Doc13. <https://doi.org/10.3205/zma001306>
- Bell, A. V., Michalec, B., & Arenson, C. (2014). The (stalled) progress of interprofessional collaboration: the role of gender. *J Interprof Care*, 28(2), 98–102. <https://doi.org/10.3109/13561820.2013.851073>
- Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., & Bethel, E. C. (2009). A meta-analysis of three types of interaction treatments in distance education. *Review of Educational Research*, 79(3), 1243–1289. <https://doi.org/10.3102/0034654309333844>
- Coster, S., Norman, I., Murrells, T., Kitchen, S., Meerabeau, E., Sooboodoo, E., & d’Avray, L. (2008). Interprofessional attitudes amongst undergraduate students in the health professions: a longitudinal questionnaire survey. *Int J Nurs Stud*, 45(11), 1667–1681. <https://doi.org/10.1016/j.ijnurstu.2008.02.008>
- Cox, M., Blouin, A. S., Cuff, P., Paniagua, M., Phillips, S., & Vlasses, P. H. (2017). The role of accreditation in achieving the quadruple aim. *NAM Perspectives*. <https://doi.org/10.31478/201710a>
- Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research*. SAGE Publications.
- Cusack, T., & O’Donoghue, G. (2012). The introduction of an interprofessional education module: students’ perceptions. *Qual Prim Care*, 20(3), 231–238.
- Dominguez, D. G., Fike, D. S., MacLaughlin, E. J., & Zorek, J. A. (2015). A comparison of the validity of two instruments assessing health professional student perceptions of interprofessional education and practice. *J Interprof Care*, 29(2), 144–149. <https://doi.org/10.3109/13561820.2014.947360>
- Evans, S., Ward, C., Shaw, N., Walker, A., Knight, T., & Sutherland-Smith, W. (2020). Interprofessional education and practice guide No. 10: Developing, supporting and sustaining a team of facilitators



- in online interprofessional education. *J Interprof Care*, 34(1), 4–10. <https://doi.org/10.1080/13561820.2019.1632817>
- Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs-principles and practices. *Health Serv Res*, 48(6 Pt 2), 2134–2156. <https://doi.org/10.1111/1475-6773.12117>
- Fusco, N. M., & Foltz-Ramos, K. (2018). Measuring changes in pharmacy and nursing students' perceptions following an interprofessional high-fidelity simulation experience. *J Interprof Care*, 32(5), 648–652. <https://doi.org/10.1080/13561820.2018.1496073>
- Gonsar, N., Patrick, L., & Cotner, S. (2021). Graduate- and undergraduate-student perceptions of and preferences for teaching practices in STEM classrooms. *Disciplinary and Interdisciplinary Science Education Research*, 3(1), 6. <https://doi.org/10.1186/s43031-021-00035-w>
- Gross, M. M., Phanudulkitti, C., Bavireddy, V., Anderson, O. S., Daniels, T., Fitzgerald, M., Mattison, D., Nagappan, K., Patterson, V., Smith, L. J., Ursuy, P. A., & Farris, K. B. (2022). Changes in student attitudes toward interprofessional education after online and in-person introductory learning activities. *Health and Interprofessional Practice*. <https://doi.org/10.7710/2641-1148.2164>
- Großer, J., Kimmerle, J., Shiozawa, T., Hirt, B., & Bientzle, M. (2020). Observing inter-professional videos: impact of collaboration between physicians and psychologists on attitude and knowledge acquisition. *J Med Educ Curric Dev*, 7, 2382120520957648. <https://doi.org/10.1177/2382120520957648>
- Guetterman, T. C., Fetters, M. D., & Creswell, J. W. (2015). Integrating quantitative and qualitative results in health science mixed methods research through joint displays. *Ann Fam Med*, 13(6), 554–561. <https://doi.org/10.1370/afm.1865>
- Guraya, S. Y., & Barr, H. (2018). The effectiveness of interprofessional education in healthcare: A systematic review and meta-analysis. *Kaohsiung J Med Sci*, 34(3), 160–165. <https://doi.org/10.1016/j.kjms.2017.12.009>
- Hallam, K. T., Livesay, K., Morda, R., Sharples, J., Jones, A., & de Courten, M. (2016). Do commencing nursing and paramedicine students differ in interprofessional learning and practice attitudes: evaluating course, socio-demographic and individual personality effects. *BMC Med Educ*, 16, 80. <https://doi.org/10.1186/s12909-016-0605-5>
- Hayward, K., Brown, M., Pendergast, N., Nicholson, M., Newell, J., Fancy, T., & Cameron, H. (2021). IPE via online education: Pedagogical pathways spanning the distance. *Journal of Interprofessional Education & Practice*, 24, 100447. <https://doi.org/10.1016/j.xjep.2021.100447>
- Jones, T. A., Vidal, G., & Taylor, C. (2020). Interprofessional education during the COVID-19 pandemic: finding the good in a bad situation. *J Interprof Care*, 34(5), 633–646. <https://doi.org/10.1080/13561820.2020.1801614>
- Khalili, H. (2020). Online interprofessional education during and post the COVID-19 pandemic: a commentary. *J Interprof Care*, 34(5), 687–690. <https://doi.org/10.1080/13561820.2020.1792424>
- Lindh Falk, A., Hammar, M., & Nyström, S. (2015). Does gender matter? Differences between students at an interprofessional training ward. *J Interprof Care*, 29(6), 616–621. <https://doi.org/10.3109/13561820.2015.1047491>
- Luke, R., Solomon, P., Baptiste, S., Hall, P., Orchard, C., Rukholm, E., & Carter, L. (2009). Online interprofessional health sciences education: From theory to practice. *J Contin Educ Health Prof*, 29(3), 161–167. <https://doi.org/10.1002/chp.20030>
- National Center for Interprofessional Practice and Education. *About the National Center*. Retrieved October 2023 from <https://nexusipe.org/informing/about-national-center>
- Oever, K. v. d., & Haans, R. F. J. (2020). An empirical test of the assumption that female and male directors contribute different perspectives. *Academy of Management Proceedings*, 2020(1), 10236. <https://doi.org/10.5465/AMBPP.2020.10236abstract>
- Poirier, T. I., Devraj, R., Blankson, F., & Xin, H. (2016). Interprofessional online global health course. *Am J Pharm Educ*, 80(9), 155. <https://doi.org/10.5688/ajpe809155>
- Shah, P., Shrestha, R., Mao, Z., Chen, Y., Chen, Y., Koju, P., Liu, X., & Li, H. (2019). Knowledge, attitude, and practice associated with antibiotic use among university students: A survey in Nepal. *Int J Environ Res Public Health*, 16(20). <https://doi.org/10.3390/ijerph16203996>
- Shaw-Battista, J., Belew, C., Anderson, D., & van Schaik, S. (2015). Successes and challenges of interprofessional physiologic birth and obstetric emergency simulations in a nurse-midwifery education program. *J Midwifery Womens Health*, 60(6), 735–743. <https://doi.org/10.1111/jmwh.12393>
- Singh, J., & Matthees, B. (2021). Facilitating interprofessional education in an online environment during the COVID-19 pandemic: A mixed method study. *Healthcare (Basel)*, 9(5). <https://doi.org/10.3390/healthcare9050567>
- Smith, L. J., Ascione, F. J., & Ruffolo, M. C. (2019). Large-scale asynchronous online interprofessional learning experience. *J Allied Health*, 48(4), e123–e130.
- Sulaiman, W. S. W., Rahman, W. R. A., & Dzulkifli, M. A. (2012). Relationship between critical thinking dispositions, perceptions towards teacher, learning approaches and critical thinking skills among university students. *The Journal of Behavioral Science*, 3(1), 122–133. <https://so06.tci-thaijo.org/index.php/IJBS/article/view/2169>
- Theodorou, J., Rotz, M., Macphail, L., Idahosa, C., Fornatora, M. L., Tweddle, E., & Virtue, S. M. (2018). Designing and evaluating an interprofessional practice experience involving dental and pharmacy students. *Am J Pharm Educ*, 82(6), 6298. <https://doi.org/10.5688/ajpe6298>
- Wilhelmsson, M., Ponzer, S., Dahlgren, L. O., Timpka, T., & Faresjö, T. (2011). Are female students in general and nursing students more ready for teamwork and interprofessional collaboration in healthcare? *BMC Med Educ*, 11, 15. <https://doi.org/10.1186/1472-6920-11-15>
- Zhang, Y., & Yang, J. (2022). Exploring gender differences in the instructor presence effect in video lectures: An eye-tracking study. *Brain Sci*, 12(7). <https://doi.org/10.3390/brainsci12070946>
- Zorek, J. A., Fike, D. S., Eickhoff, J. C., Engle, J. A., MacLaughlin, E. J., Dominguez, D. G., & Seibert, C. S. (2016). Refinement and validation of the student perceptions of physician-pharmacist interprofessional clinical education instrument. *Am J Pharm Educ*, 80(3), 47. <https://doi.org/10.5688/ajpe80347>