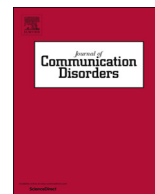


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Interprofessional education during an autism session

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ABSTRACT

Interprofessional education (IPE) gained a strong foothold in the beginning of the twenty-first century as an effort to improve care to patients through enhanced teamwork. The aim of this study was to compare attitudes and experiences of the learners, which included graduate students, physicians in training, and practicing healthcare professionals, before and after an interprofessional clinical practice (IPCP) six-h autism didactic and experiential training session. The training session consisted of a 1-h lecture on Autism Spectrum Disorder (ASD), a 2-h behavior review meeting consisting of four different case study discussions among the learners, a 1-h lunch, a 1-h therapy session with children diagnosed with ASD, and a 1-h discussion among the learners. The IPCP learners (n = 63) completed a pre- and post-learning questionnaire of the Readiness for Interprofessional Learning Scale (RIPLS) and 12 Statements instruments and both showed an overall significant improvement in the learners interprofessional education after completing the training session. This study was able to show that students, professional trainees, and practicing professionals from different backgrounds led by an expert in the field can exchange ideas and role perceptions in an interprofessional didactic and experiential session, and develop improved attitudes toward IPCP. Moving forward, interprofessional education research needs to focus more on professional trainees and practicing professionals working together in combined didactic and experiential environments for children diagnosed with ASD.

1. Introduction

Interprofessional education (IPE) gained a strong foothold in the twenty-first century as an effort to improve care to patients through enhanced teamwork (Goin-Kochel, Mackintosh, & Myers, 2006; Howell, Wittman, & Bundy, 2012; Kohn et al., 1999). Individuals with Autism Spectrum Disorder (ASD) often present to health care providers with complex treatment needs (Summers, Bartha, & Desarkar, 2016; Sheridan & Kratochwill, 2007). These complex treatment needs require interprofessional collaboration where several professionals from different disciplines work together to provide the most optimal care for individuals with ASD (Summers et al., 2016). Interprofessional care establishes a collaboration between health care providers in order to provide a

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coordinated approach to care for these individuals and their families. Therefore, treatment decisions for these individuals are often made by several clinicians who participated in their care. This collaboration improves health outcomes and care for individuals with ASD, significantly reduces stress from the health care providers, and improves organization efficiency (Health Force Ontario, 2010; Rosen & Callaly, 2005). Thus, interprofessional teams are best equipped to manage treatment plans and services for individuals with ASD over a period of time (Ellis, Lutz, & Schaefer, 2007).

Prior IPE ASD studies have included student participation in health care teams with children with ASD from different disciplines such as social work, education, medicine, nursing, and psychology (Howell et al., 2012; Loutzenhiser & Hadjistavropoulos, 2008; Self & Parham, 2016; Werner, 2011). One of these studies found that working with individuals diagnosed with ASD was perceived as difficult, challenging, and frustrating, yet rewarding, important, and an opportunity to develop personally and professionally (Werner, 2011). Also, the students in this study perceived familiarity, knowledge, and training as important factors during their IPE experience. Thus, this study showed that IPE can simultaneously improve a student's understanding of professional roles and ASD treatment plans. In a different study, researchers conducted an IPE ASD clinical learning experience for pre-licensure occupational therapy and psychology graduate students in which students worked in interprofessional teams to plan and implement a social skills training program for children with ASD (Howell et al., 2012). This study found that the interprofessional clinical learning experience helped ensure that students were adequately prepared to represent their profession as part of a diverse interprofessional health care team. Additionally, IPE has been shown to considerably decrease medical errors and adverse events when providing health care to patients (Schnipper et al., 2006). Evidence suggests that IPE may benefit health professional students when they interact during practical hands-on experiences (Howell et al., 2012).

IPE studies have predominantly focused on professional students. Specific issues that these studies have focused on include a student's self-perception of an interprofessional ASD education (Self & Parham, 2016), on a student's social skills training during an ASD program (Howell et al., 2012), the assessment of a female student's attitude in health and social professions towards working with ASD populations (Werner, 2011), and the enhancement of an interprofessional patient-centered practice for children with ASD (Loutzenhiser & Hadjistavropoulos, 2008). However, there has been little research that has focused on interprofessional clinical practice (IPCP) involving graduate students, physicians in training, and practicing healthcare professionals during the same learning experience. The aim of this study was to compare attitudes and experiences of the learners before and after an IPCP six-h autism didactic and experiential training session. The learners included graduate students, physicians in training, and practicing healthcare professionals.

2. Methods

From January 22, 2016 to September 15, 2016, learners participated in one six-h didactic and experiential autism training session that was held in three different autism center locations (Novi, Detroit, and Macomb) throughout the Detroit metropolitan area in Michigan. The training learning objectives included; 1) to identify core skills being taught through treatment and what core deficit area of ASD they relate to; 2) to identify reinforcers and motivation during teaching; 3) to identify and describe the symptoms of autism related to the two primary diagnostic categories of social communication and repetitive/stereotyped behaviors; 4) to identify at least five characteristics of Applied Behavioral Analysis (ABA) and who (persons, skill levels, age levels) can benefit from ABA; 5) to have a fundamental understanding of the Autism Diagnostic Interview and Autism Diagnostic Observation and to identify referral resources for services for a child suspected of an ASD diagnosis and/or additional therapy resources; 6) to understand the benefits of parent involvement during the course of treatment as well as the parent perspective of referral, diagnosis, and stressors related to treatment; 7) to be able to provide community resources available for children and parents; and 8) to observe and engage in an interdisciplinary ASD care team treatment planning meeting. IRB approval for the training session was granted by Wayne State University. The training session was sponsored by the Michigan Department of Health and Human Services as part of a grant to expand the number of ASD services in the state of Michigan.

2.1. Participants

The learners included medical, nurse practitioner, psychology, and physician assistant students, physicians in training (family medicine, pediatrics, and pediatric neurology residents), nursing faculty, and board certified behavior analysts. The learners voluntarily participated in the training session and were recruited by the directors of their programs (both students and non-students). Directors from the various programs were made aware of the training session and advised health professional/graduate students and physicians in training of the ASD interdisciplinary training available. The students received credit to complete their professional/graduate programs and the non-students such as physicians in training received credit for completing their residency programs and practicing healthcare professionals received continuing education credits. There was no cost for the training. All recruited learners participated in the training session. The team of learners signed up for a training session from a list of sessions that were available on a weekly basis at each of the three locations (Novi, Detroit, and Macomb). Each training session had 3 to 8 learners that represented at least 3 different professional disciplines from the Wayne State University programs. Therefore, the training did not target any specific program or year of the health professional/graduate student, therefore, any health professional/graduate student, physician in training, or practicing healthcare professional could attend the training session. The learners that did not provide an informed consent were excluded from the study. A pre- and post-quasi-experimental design was used to evaluate a learner's understanding and experiences of IPCP during the training session.

2.2. Procedures

The training session was provided by the director of behavioral services at all three training locations. This is an expert in the field who has been working with children with ASD for the last 20 years and oversees the behavior analysis training program at Wayne State University and has participated in several ASD groups in the development of ASD services for the state of Michigan. The director of behavioral services created the training session with assistance in delivering the session from staff trained in behavior analysis at all of the training locations. All IPCP learners registered online for the training session and completed a registration form to collect demographic information (e.g. age, ethnicity, educational background and discipline) and pre-learning questions using Survey Monkey® (SurveyMonkey Inc.). Post-learning questions were administered in-person at the end of the training session.

The six-h training session included; 1) a one-h didactic training that covered topics including ASD symptoms, early screening, diagnosis, ABA treatment, referral sources in the community, the parent perspective of accessing treatment and raising a child with ASD, and working together in a multi-disciplinary way with other professionals who commonly treat children with ASD; 2) a two-h experiential, interprofessional case presentation (which included 4 case studies) activity where professionals from several different disciplines would review patients at a local ABA treatment clinic and discuss issues related to the treatment and ongoing care of each patient as a team. The case presentation topics of discussion included treatment conceptualization, barriers to treatment, parent involvement, risks to treatment, ethical considerations, medical complication, and coordination with other disciplines; 3) a working lunch during which learners shared experiences related to the morning training on their own; 4) a live observation of ABA services at the clinic; and 5) a follow up interprofessional group discussion regarding the roles of each learner in the treatment of ASD and how the information learned in the training can be transferred to their individual practices once they enter the workforce.

2.3. Instruments

The Readiness for Interprofessional Learning Scale (RIPLS) (Parsell & Bligh, 1999) and the 12 Statements surveys (Le, Spencer, & Whelan, 2008) were presented to the IPCP learners to assess their understanding and experiences of interprofessional education before and after the training session. The demographic tool was developed by the evaluation team using standardized demographic questions linked to Health Resources and Services Administration (HRSA) data collection variables.

The RIPLS consists of a total of 19 items and based on the original study the factor analysis addressed teamwork & collaboration, professional identity, and roles & responsibility (Parsell & Bligh, 1999). Specific items from the RIPLS tool include; “Shared learning with other health and social care students / professionals will increase my ability to understand clinical problems;” “I don't want to waste time learning with other health and social care students / professionals;” “Shared learning and practice will help me clarify the nature of patients' or clients' problems;” and “I am not sure what my professional role will be / is.” These RIPLS items have been used in studies to explore views and attitudes of health professional students in nursing, medicine, physiotherapy, and dietetics (Hood et al., 2014). The learners rated their level of agreement with each of the items using a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree). The RIPLS was determined valid and reliable with its original inception (Parsell & Bligh, 1999), and a later study substantiated its validity and reliability by adding a fourth factor (McFadyen et al., 2005). A further study using factor analysis suggested the removal of two items from the RIPLS tool but recommended further refinement of the tool (Williams, Brown, & Boyle, 2012). Finally, a commentary suggested three key problems with the RIPLS including psychometrics, factor structure variation, and attitude measurement (Mahler, Burger, & Reeves, 2015). Despite these concerns with the 19-item RIPLS tool, we adopted a modified version of the tool that is currently utilized by the National Center for Interprofessional Practice and Education (National Center for Interprofessional Practice and Education). This adapted version of the tool includes specific wording of the questions (e.g., learning between health and social care students before qualification and for professionals after qualification would improve working relationships after qualification/collaborative practice) that we found useful for the autism training session to assess several disciplines including students and practicing professionals.

The 12 Statements addressed roles and responsibilities, teamwork & collaboration, and improved clinical practice. Specific items from the 12 Statements tool include; “Learning with other students helps me in becoming a more effective member of a healthcare team;” “It is important for me to think positively about other healthcare professionals;” and “Learning with other healthcare students increases my ability to understand clinical problems.” These items have been utilized to measure positive interprofessional learning experiences for students from medicine, nursing, and pharmacy (Le et al., 2008). Content validity and construct validity for the 12 Statement tool was assessed using exploratory factor analysis in a previous study showing that the tool is reliable (Le et al., 2008). Thus, these reliability findings of the 12 Statements tool indicate that the tool is suitable for measuring a learner's understanding and experiences of an IPE program.

2.4. Data analysis

Analyses were performed on PC with Microsoft Windows 7 operating system, using SAS statistical software (SAS version 9.2, SAS Institute Inc., Cary, NC, USA). Means with standard errors were calculated for continuous characteristics, and percentages with standard errors were calculated for categorical characteristics. The interprofessional education program in this study was assessed using a paired sample design that required learners to complete a survey before (pre-learning) and after (post-learning) the autism training session. The pre-learning score and the post-learning score were recorded for each survey question among all IPCP learners. The pre-learning average score and post-learning average score were calculated to reflect the change in average score for each question in the RIPLS and 12 Statements surveys. The average difference with 95% confidence intervals between pre- and post-

Table 1
Interprofessional Clinical Practice Learner Characteristics, N = 63.

Characteristics	Count	Means/percentages
Age (years) ^a	62	29.6
Gender (%)	13	20.6
Male	50	79.4
Female		
Race/ethnicity (%) ^a	41	66.1
Non-Hispanic white	5	8.1
Non-Hispanic black	1	1.6
Hispanic	11	17.7
Asian	4	6.5
other		

^a Our sample is missing the age and race/ethnicity identity for 1 of 63 learners.

learning scores was calculated to evaluate the improvement in scores before and after the training session. The significant difference in score represents a change in the assessment of the learner's understanding and experiences of interprofessional education and the difference was considered to be significant if the p value was less than 0.05. Please note that the following 4 items were reversely coded in the RIPLS survey prior to calculating the pre- and post-learning scores, "I don't want to waste time learning with other health and social care students / professionals;" "It is not necessary for undergraduate /postgraduate health and social care students / professionals to learn together;" "Clinical problem solving can only be learned effectively with students / professionals from my own school / organization;" "I am not sure what my professional role will be / is." Next, we conducted a domain analysis by separating each of the questions for both the RIPLS and 12 Statements surveys into their respective domains. For the RIPLS, we included the following 4 domains which were teamwork & collaboration, negative professional identity, positive professional identity, and roles & responsibility. For the 12 Statements, we included the following 3 domains which were roles and responsibilities, teamwork & collaboration, and improved clinical practice. Finally, we analyzed differences in pre- and post-learning scores on the RIPLS and 12 Statements for each subgroup defined by age, gender, race/ethnicity, and discipline.

3. Results

Table 1 shows demographic characteristics of the IPCP learner sample, including age, gender, and racial/ethnic characteristics. The IPCP learners' (n = 63) average age was 29.6 years and the majority of the learners were female (n = 50, 79.4%). Most of the learners were non-Hispanic white (n = 41, 66.1%) followed by Asians (n = 11, 17.7%), and non-Hispanic blacks (n = 5, 8.1%).

Table 2 shows the different disciplines that participated in the IPCP session. The IPCP learners included students from health professional and graduate programs, and non-students included physicians in training (residents) and practicing healthcare professionals. Graduate nurse practitioner students (n = 17, 27.0%) and medical students (n = 16, 25.4%) represented the largest groups of the learners followed by physician assistants (n = 10, 15.8%) and physicians in training (n = 9, 14.3%). Other disciplines that participated in the ASD sessions included psychology and board certified behavior analysts.

Table 3 shows the RIPLS pre- and post-learning average score for each question separated by domain. The IPCP learners were asked to complete the RIPLS pre- and post-learning questionnaire regarding their interprofessional education experience and the overall pre- to post-learning score had a statistically significant improvement (p = .001). The learners showed the most change in perceptions with items that focused on communication skills ("communications skills should be learned with other health and social care students/professionals," p = .002), learning together ("learning between health and social care students before qualification and for professionals after qualification would improve working relationships after qualification/collaborative practice," p = .001),

Table 2
Disciplines Participating in the Interprofessional Clinical Practice Sessions, N = 63.

Trainee discipline	Count	Percentage (%)
Nursing-Graduate Students (master's and doctoral level)	17	27.0
Medicine Students (years 1–3 of medical school)	16	25.4
Physician Assistant Students (master's level)	10	15.8
Physicians in Training (residents)	9	14.3
Board Certified Behavior Analysts	3	4.8
Psychology-Graduate Students (master's level)	3	4.8
Graduate-Other Students (master's level)	2	3.2
Nursing-Faculty	1	1.6
Unknown ^a	2	3.2
Total	63	100.1 ^b

^a Unknown, because the learners were not required to complete all questions of the demographic information survey when they registered for the six-h training session.

^b The slight discrepancy is due to rounding.

Table 3

The Readiness for Interprofessional Learning Scale (RIPLS) Pre- and Post-Learning Average Score for Each Question Separated by Domain, N = 63.

RIPLS Statements	Pre Avg. Score	Post Avg. Score	Difference (95% CI)	P value
Domain 1: Teamwork & Collaboration				
Learning with other students /professionals will make me a more effective member of a health and social care team	4.56	4.77	0.21 (0.044, 0.38)	.014
Patients would ultimately benefit if health and social care students / professionals worked together	4.62	4.82	0.20 (0.017, 0.38)	.032
Shared learning with other health and social care students / professionals will increase my ability to understand clinical problems	4.57	4.79	0.21 (0.037, 0.39)	.018
Communications skills should be learned with other health and social care students / professionals	4.52	4.80	0.28 (0.10, 0.45)	.002
Team-working skills are vital for all health and social care students / professionals to learn	4.72	4.75	0.033 (-0.18, 0.25)	.761
Shared learning will help me to understand my own professional limitations	4.54	4.75	0.21 (0.025, 0.40)	.026
Learning between health and social care students before qualification and for professionals after qualification would improve working relationships after qualification / collaborative practice.	4.54	4.84	0.30 (0.12, 0.47)	.001
Shared learning will help me think positively about other health and social care professionals	4.49	4.72	0.23 (0.024, 0.44)	.029
For small-group learning to work, students / professionals need to respect and trust each other	4.74	4.79	0.049 (-0.14, 0.24)	.608
Construct of Domain 1	4.60	4.78	0.18 (0.029, 0.32)	.019
Domain 2: Negative Professional Identity				
I don't want to waste time learning with other health and social care students / professionals	4.23	4.62	0.39 (0.004, 0.78)	.047
It is not necessary for undergraduate /postgraduate health and social care students / professionals to learn together	4.25	4.59	0.34 (0.045, 0.64)	.024
Clinical problem solving can only be learned effectively with students / professionals from my own school / organization	4.08	4.23	0.15 (-0.25, 0.54)	.461
Construct of Domain 2	4.19	4.48	0.29 (0.016, 0.57)	.038
Domain 3: Positive Professional Identity				
Shared learning with other health and social care professionals will help me to communicate better with patients and other professionals	4.48	4.74	0.26 (0.065, 0.46)	.013
I would welcome the opportunity to work on small group projects with other health and social care students/professionals	4.26	4.54	0.28 (0.018, 0.54)	.036
I would welcome the opportunity to share some generic lectures, tutorials or workshops with other health and social care students / professionals	4.23	4.59	0.36 (0.084, 0.64)	.011
Shared learning and practice will help me clarify the nature of patients' or clients' problems	4.46	4.77	0.31 (0.15, 0.47)	.001
Shared learning before and after qualification will help me become a better team worker	4.48	4.77	0.30 (0.12, 0.47)	.001
Construct of Domain 3	4.38	4.68	0.30 (0.13, 0.47)	.001
Domain 4: Roles & Responsibility				
I am not sure what my professional role will be / is	3.56	4.00	0.44 (0.17, 0.71)	.001
I have to acquire much more knowledge and skill than other students/ professionals in my own faculty/organization	2.52	2.67	0.15 (-0.14, 0.43)	.297
Construct of Domain 4	3.04	3.34	0.30 (0.13, 0.46)	.001
Total for each learner	81.85	86.56	4.70 (2.23, 7.18)	.001

shared learning and practice (“shared learning and practice will help me clarify the nature of patients’ or clients’ problems,” $p = .001$), and professional role identification (“I am not sure what my professional role will be/ is,” $p = .001$). Although the learners’ post-learning scores improved on most of the questions, for the following four questions we did not achieve statistically significant improvement; “team-working skills are vital for all health and social care students/professionals to learn;” “for small-group learning to work, students/professionals need to respect and trust each other;” “clinical problem solving can only be learned effectively with students/professionals from my own school/organization;” and “I have to acquire much more knowledge and skill than other students/ professionals in my own faculty/organization.” The learners’ post-learning scores improved significantly in all four domains, but the most change occurred with the positive professional identity and roles and responsibilities domains.

Table 4 shows the 12 Statements pre- and post-learning average score for each question separated by domain. The IPCP learners were also asked to complete the 12 Statements pre- and post-learning questionnaire regarding their interprofessional education experience and the overall pre- to post-learning score had a statistically significant improvement ($p = .001$). The learners showed the most change in perceptions with questions focused on learning with other students (“learning with other students helps me in becoming a more effective member of a healthcare team,” $p = .002$), teamwork (“it is important for me to think positively about other healthcare professionals,” $p = .001$), solving clinical problems as a team (“patients ultimately benefit if healthcare students work together to solve patient problems,” $p = .001$). The learners’ post-learning scores improved significantly in all three domains.

Table 5 shows the differences in pre- and post-learning scores for each subgroup defined by age, gender, race/ethnicity, and discipline for both the RIPLS and 12 Statements. Differences in pre- and post-learning scores varied. For the RIPLS, younger students (21–25 years, $p = .001$), Asians ($p = .004$) and physician assistant students ($p = .004$) showed significant improvement after the training session. In contrast to the 12 Statements, older learners (> 35 years, $p = .003$), non-Hispanic whites ($p = .004$), Asians ($p = .003$) and graduate nursing students ($p = .001$) displayed the most improvement. Finally, female students ($p = .001$) seemed to show the most change in perceptions after the training session. We conducted a multiple regression (as a confirmatory analysis) to

Table 4
The 12 Statements Pre- and Post-Learning Average Score for Each Question Separated by Domain, N = 63.

12 Statements	Pre Avg. Score	Post Avg. Score	Difference (95% CI)	P value
Domain 1: Roles and Responsibilities				
Learning with other students helps me in becoming a more effective member of a healthcare team.	4.57	4.82	0.25 (0.093, 0.40)	.002
Peer learning among healthcare students could improve working relationships after training.	4.62	4.82	0.20 (0.036, 0.36)	.017
Learning with students from other health professions gives me a better understanding of roles and responsibilities.	4.56	4.80	0.25 (0.086, 0.41)	.003
I want to have a greater understanding of my profession in a healthcare team.	4.48	4.70	0.23 (0.029, 0.43)	.025
Construct of Domain 1	4.54	4.78	0.24 (0.093, 0.39)	.001
Domain 2: Teamwork & Collaboration				
It is important to develop an understanding of the resources and networks required to assist people with health-related problems in the rural community.	4.69	4.89	0.20 (0.075, 0.32)	.002
It is important for me to think positively about other healthcare professionals.	4.56	4.89	0.33 (0.18, 0.47)	.001
It is important for nurses, pharmacists and doctors to work closely together.	4.67	4.92	0.25 (0.12, 0.38)	.001
Team-working skills are essential for all healthcare students to learn.	4.66	4.89	0.23 (0.11, 0.35)	.001
Working with other health professionals enhances my professional practice.	4.57	4.89	0.31 (0.15, 0.47)	.001
Construct of Domain 2	4.62	4.89	0.27 (0.16, 0.39)	.001
Domain 3: Improved Clinical Practice				
Patients ultimately benefit if healthcare students work together to solve patient problems.	4.57	4.92	0.34 (0.20, 0.49)	.001
*Learning with other students helps me become a more effective member of a healthcare team.	4.57	4.84	0.26 (0.13, 0.39)	.001
Learning with other healthcare students increases my ability to understand clinical problems.	4.59	4.84	0.25 (0.086, 0.41)	.003
Construct of Domain 3	4.57	4.87	0.31 (0.18, 0.43)	.001
Total for each learner	55.11	58.19	3.08 (1.72, 4.44)	.001

*There is a distinction between the following two statements. The “Learning with other students helps me *become* a more effective member of a healthcare team,” refers to the importance of students learning and working together for improved clinical practice. The “Learning with other students helps me in *becoming* a more effective member of a healthcare team,” refers to a learner’s appreciation of professional roles and responsibilities and the importance of a team approach.

Table 5
Differences in pre- and post-learning scores for each subgroup defined by age, gender, race/ethnicity, and discipline for both the RIPLS and 12 Statements.

Characteristics	RIPLS				12 Statement			
	Pre-test average	Post-test average	Difference (95% CI)	P value	Pre-test average	Post-test average	Difference (95% CI)	P value
Age group (%)	81.2	87.3	6.1 (2.6, 9.6)	.001	56.2	58.5	2.3 (.47, 4.1)	.016
21-25	82.2	86.8	4.6 (-0.46, 9.7)	.068	55.1	57.8	2.7 (.006, 5.4)	.049
25-30	80.5	87.0	6.5 (-3.0, 16.0)	.139	55.3	59.2	3.8 (-2.2, 9.9)	.159
31-35	84.5	84.8	0.3 (-7.0, 7.6)	.928	51.85	58.2	6.4 (2.8, 9.9)	.003
≥35								
Gender (%)	81.1	83.3	2.2 (-6.6, 10.9)	.601	55.6	56.3	0.75 (-1.9, 3.4)	.539
Male	82.3	87.4	5.1 (2.6, 7.7)	< .001	54.8	58.7	3.9 (2.3, 5.5)	.001
Female								
Race/ethnicity(%)	82.5	86.2	3.7 (.087, 7.3)	.045	55.5	58.0	2.5 (.82, 4.2)	.004
Non-H White	78.5	84.0	5.5 (-5.9, 16.9)	.218	53.8	59.3	-5.5 (-4.7, 5.7)	.179
Non-H Black	80.6	88.5	7.8 (3.0, 12.6)	.004	51.8	58.1	6.2 (2.6, 9.9)	.003
Asian	82.8	86.8	4.0 (-0.11, 8.1)	.053	58.0	59.0	1.0 (-4.0, 6.0)	.569
Other								
Profession (%)	82.3	86.2	3.9 (-1.1, 8.9))	.119	53.2	58.7	2.4 (0.42, 4.4)	.019
Medicine	82.5	86.8	4.3 (-.022, 8.7)	.051	53.6	57.8	5.5 (2.6, 8.4)	.001
Nursing	78.3	87.7	9.3 (3.9, 14.8)	.004	56.8	58.7	1.9 (-1.4, 5.2)	.218
PA	84.4	85.9	1.5 (-4.5, 7.5)	.569	54.3	56.5	2.3 (-2.6, 7.1)	.309
Other								

PA = Physician Assistant, Non-H = Hispanic.

examine the confounding influence of age, gender, race, and discipline on the score change in pre- and post-learning. The influence of these characteristics was not statistically significant (compared to reference groups, all p values greater than .05).

4. Discussion

Our study was unique because it involved a combination of professional students (medicine, nursing, psychology, and physician assistant), physicians in training, and practicing healthcare professionals (nursing faculty, board certified behavior analysts) during the same interprofessional learning experience. This interprofessional learning experience gave the opportunity to a diversified group

of learners from different backgrounds to interact (Oandasan & Reeves, 2005) and aided in understanding professional roles (Arndt et al., 2009). In addition to the interprofessional experience, the learners gained knowledge on ASD-related material, which targets areas in which learners have shown a lack of knowledge (Summers et al., 2016). Further follow-up is needed to study the effect the training may have had on professionals' screening and referring to appropriate services in the community during practice.

As mentioned earlier, four ASD case studies were presented during the experiential portion of the training session. Learners were also able to observe live Applied Behavioral Analysis (ABA) sessions with children who have ASD from a variety of ages and varying symptoms while at the local center based ABA program. Then students, professional trainees, and professionals were given the opportunity to discuss these topics and learn the roles of their discipline and other disciplines in treating children with ASD. These activities not only educated the learners on ASD symptoms, but also offered a range of functioning level and different treatment approaches to assist individualized treatment based on the needs of each child with ASD.

The majority of the RIPLS post-learning question scores improved significantly indicating improved perceptions and attitudes towards interprofessional education. The most significant changes towards interprofessional education were detected in items focused on communication skills, learning together, shared learning, and positive professional role identity. The training session intentionally required participants to engage in shared learning through communicating with one another about real-life ASD cases. It also required the participants to share how their own professional discipline diagnoses and treats children and families with ASD. The training session demonstrated and forced participants into a case-based learning scenario which in turn improved their perceptions of their communication skills and shared learning.

The major changes in the roles and responsibilities questions/domains may be explained by the fact that younger and perhaps unexperienced learners (the majority were younger medical and graduate nursing students) may have been unsure about the roles and responsibilities of their discipline. A different question regarding negative professional identity that stated, "I don't want to waste my time learning with other health and social care students / professionals," also showed a significant change towards interprofessional education. This question may be linked with the previous question in that younger learners may not have been exposed to interprofessional education and after the training session realized the benefit of working in teams with other disciplines. Thus, it may have been an asset for our study to include learners from several different disciplines and career backgrounds (students, professional trainees, and practicing professionals) during the autism training session.

However, no change was seen in four items ("Team-working skills are vital for all health and social care students / professionals to learn;" "For small-group learning to work, students / professionals need to respect and trust each other;" "Clinical problem solving can only be learned effectively with students / professionals from my own school / organization;" and "I have to acquire much more knowledge and skill than other students/ professionals in my own faculty/organization") from three of the four domains. These contradictory findings may be explained by the structure of the training session provided to learners and a possible ceiling effect from the four items. The four items were already near the maximum score at the pre-learning score (e.g. 4.72/5.0). The high pre-learning scores had little opportunity for change following the training session. It may also be that the wording of the items forced a socially desirable response from participants. For example, two of the items use terminology such as, "can only be" or "much more knowledge" that participants knew how they "should" respond. Future researchers may want to include a measure of social desirability to ensure the validity of the responses.

There was an improvement in all of the 12 Statements post-learning question scores. This indicated a significant positive change towards understanding and experiences with interprofessional education. The learners were able to describe symptoms of autism related to the primary diagnostic category of social and communication behaviors during the training session. The combination of didactic and experiential activities generated a discussion among the disciplines. We speculate that the varied activities contributed to the significant improvement in teamwork and collaboration and improved clinical practice. The improvement in teamwork and collaboration was noted in the following questions; "it is important for me to think positively about other healthcare professionals" and "working with other health professionals enhances my professional practice." The improvement in clinical practice was noted in the following question, "patients ultimately benefit if healthcare students work together to solve patient problems." Other areas that were discussed in the interprofessional sessions included community resources for children with ASD in rural communities which may explain the significant change in the instrument question that stated, "It is important to develop an understanding of the resources and networks required to assist people with health-related problems in the rural community." Future research for this type of training could include measuring longitudinal data on trainees, specifically the effects of the training on the learners' practice behavior once they enter the field or return to work.

The differences between the two instruments by age, race-ethnicity and profession are likely unreliable given our small sample size and should be treated with caution. No studies could be found that explain age differences by instrument. Future studies will need to repeat these analyses to determine if our findings are random. The small number of non-Hispanic black learners likely impacted the race and ethnicity findings. Similar to the differences in scores by age between the instruments, the professional differences may be a spurious finding of our small sample size; however, the differences by gender are notable. It may be that this type of training had a greater effect on female learners. Yet since the majority of the learners were female, the small number of male participants may have contributed to the findings.

We identified several limitations in our study. First, key problems have been identified with the RIPLS tool which include psychometrics, factor structure variation, and attitude measurement (Mahler et al., 2015). Second, the board certified behavior analysts that participated in the training were working with children with ASD and their families on a daily basis; whereas the professional students, physicians in training, and healthcare professionals had less experience with children with ASD. Although this challenge was a limitation, it may have been a tremendous opportunity for novice professional students to gain a wealth of knowledge on ASD-related material, observations, and experiences shared by the more experienced professionals. Third, the results of the study cannot

be extended to any changes in practice. Fourth, the learners modified attitudes and perceptions after the training session may not be sustainable over time. Fifth, the likelihood of bias in responding may have affected our results. For example, the desirable response in most of the questions from both instruments may have been quite obvious to the learners leading to social desirability bias. Sixth, the two instruments were very similar as well as many of their questions which may have created the likelihood that a response to one question would influence responses to other questions. Seventh, p-values for multiple comparisons were not corrected in our analysis which may have inflated the likelihood of Type 1 errors and many of the comparisons would not have been significant if this had been done. Lastly, our small sample size warrants treating our findings with caution.

Despite the limitations, this study was able to show that students, professional trainees, and practicing professionals from different backgrounds led by an expert in the field can exchange ideas and role perceptions in an interprofessional didactic and experiential session, and develop improved attitudes toward IPCP. Future research is needed on the variability in learner's experiences of diversified groups that include students and practicing professionals. Also, further research is needed to improve the reliability of the RIPLS and 12 Statements. Finally, longitudinal data should be collected to measure sustainability over a longer period of time.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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