

Behavioral outcomes of online interprofessional education for graduate physical therapy and nurse practitioner students

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ABSTRACT

Background/Purpose- Authors assessed changes in behavioral outcomes and observed student reflections regarding interprofessional collaboration (IPC) for current, practicing nurses enrolled in a nurse practitioner program and doctor of physical therapy students (DPT) post-interprofessional education (IPE) training.

Method- Paired t-test to determine differences in students' pre- to post-test assessment scores regarding behavior and application of IPC training. Regression analysis to indicate if those differences could be explained by factors such as profession, gender, age, assignment 1, assignment 2, pre-test, or prior GPA. Main outcome measure was pre- to post-IPC training scores.

Discussion- Statistically significant improvements occurred when comparing pre- to post-test IPC scores. Regression analysis revealed Assignment 2 and the pre-test were significant predictors that can explain changes of IPC scores.

Conclusion- IPE and interactions for nurse practitioner and doctor of physical therapy students improves student behaviors toward IPC and positive reflections regarding IPC. Those who have been exposed to IPC in their current healthcare setting are associated with greater understanding of IPE training.

Key Words: interprofessional collaboration, interprofessional education, online education, healthcare collaboration

INTRODUCTION

Effective interprofessional collaboration (IPC) is considered essential for optimal healthcare delivery and, thus, the need to include interprofessional education (IPE) in all levels and formats of health professions programs is crucial.¹ IPE is the collaboration of various professions for the good of the patient, which occurs when professionals learn about, from, or with each other to enable effective collaboration and improve healthcare outcomes. Research has shown that interventions addressing IPC issues between health care professionals have the potential to enhance professional practice and healthcare outcomes.² More specifically, one study performed on daily interdisciplinary rounds in an acute care setting showed a positive impact on length of stay and accuracy with patient charges/billing, while another study found that multidisciplinary meetings with a focus on collaborative working were associated with increased reporting processes and improvements in care provided.^{2,3} There is strong evidence that IPC within the health care system provides reduced patient care costs.⁴ As early as the 1940s, IPE was identified as a necessity for the success of patient rehabilitation.⁵ Since the 1970s, IPE has been recognized as its own field of study.⁶ Recently, the literature contains evidence of successful IPE in traditional health professions classrooms and programs to enable collaborative teamwork, enhanced rapport among healthcare professionals, and insight into the value of IPC and healthcare delivery.^{3,7,8,9}

Today, as more graduate, healthcare, and professional degrees are earned online, further research is warranted to identify the factors that impact IPE learning outcomes. For instance, Kemp, et al. found no significant differences in online modules and face-to-face content delivery of IPE.¹⁰ This suggests that online methods of learning are as effective as face-to-face learning. A study by Campbell, et al. found that web-based training was as successful as a blended method

in which students attend face-to-face seminars and were given online materials as well.¹¹ Such findings provide evidence for the potential of virtual learning environments in a web based program.¹¹

The current study provided online IPE training in a distance education nurse practitioner program and in a traditional doctor of physical therapy classroom. The researchers assessed whether students' behavioral scores regarding IPC were improved after receiving the IPE training. Student reflections were also recorded in the form of a formal focus group, conducted via online camera for the distance education nursing students and in the classroom for the DPT students. The focus groups allowed the students from both disciplines to elaborate on their experiences in their respective healthcare environments with IPE before and after the IPE training.

The hypothesis of this study proposes that both NP and DPT students will improve behavioral outcomes and application of IPC from online IPE training. We investigated possible factors which may influence the learning outcomes including profession, gender, age, assignment 1, assignment 2, pre-test scores, and prior grade point average (GPA). In a previous study, GPA was found to explain the larger percentage of improved post-test IPE scores.¹² The authors hypothesize that GPA may be a factor in predicting performance in the current study. A study also found that gender influenced learning outcomes and that females found IPE training more beneficial than men.¹³ The purpose of this study is to assess integration of online IPE between NP and DPT students and identify its potential to positively impact IPC in a healthcare environment.

METHODS

Participants

Participants in the study were recruited from two graduate health professions programs, the DPT and the NP programs based at Angelo State University (ASU) in San Angelo, Texas. This study was approved by the Institutional Review Board at ASU, and all participants were consenting students (N=25 DPT students; mean age $25.08 \pm 3.5y$, 10 males; N=18 NP students, mean age $37.6 \pm 8.0y$, 3 males). NP students were current, practicing nurses enrolled in a nurse practitioner program and thus in the Advanced Health Assessment (NUR 6331) online course. DPT students were enrolled in the course entitled Foundations for Systems Review (DPT 7232). Physical therapy students participated as part of a traditional, classroom based course, nursing students participated as part of an online, distance-learning course, and both groups of students learned IPE from online technologies, and face-to-face verbal & written interaction with each other. To protect the confidentiality of each participant, the investigators utilized a confidential program that is available via only passcode. The data obtained was listed by a random participant number, and only primary investigators had the master code to complete data analysis.

Research Design

Volunteer participants of both the DPT and NP courses completed a pre-course and post-IPC test describing their behavior and experience with IPC. Pre- and post-tests included the Interprofessional Collaboration Scale (Appendix 1), which has been utilized by other authors measuring interdisciplinary collaboration.¹⁴ The following time frame was used for all assignments and assessments in spring semester of 2014: pre-test in January, IPC training module in February, assignment 1 in February, assignment 2 in March, and post-test in April. All

participants received the same online IPE training and assessment embedded throughout the standard courses of focus, NUR 6331 and PT 7232 as follows.

a. IPC training module for all NP and DPT student participants.

The IPC training included Blackboard assisted learning modules developed by NP and DPT professors, as follows: definition of IPE, evidence-based materials explaining the importance of IPE and IPC for improving health services, patient care and safety, chronic disease outcomes, and evidence-based modules explaining how IPC decreases hospital length of stay, staff turnover, clinical errors, mortality rate, and tension among caregivers. The students were provided the vision of IPC within online teaching materials, to provide patient-centered care, and an expansion upon the four domains of interprofessional practice (values/ethics, roles and responsibilities, interprofessional communication, and teams/teamwork) as provided by Interprofessional Education Collaborative (IPEC) in 2013. Contents available for review by contacting the corresponding author at hbraden@angelo.edu.

b. Assignment 1

One to two DPT students conducted a geriatric screening and interview of random assignment in a local senior care facility and obtained the participant's history, risk factors, and red flags/symptoms. The university established written consent by the facility review board to conduct DPT student interviews with the residents. Students obtain HIPPA training in their DPT curriculum. Resident participants signed a consent form to participate, explaining no name/number identifiers would be attached to the interview information they provide. With no names or identifying information included, the DPT students shared the interview findings of the geriatric resident participant with a randomly assigned NP student, just as a physical therapist might discuss with an actual NP referral source. IPC, via face-to-face meetings, phone

correspondence, and/or written communication, was completed to determine an appropriate plan for the geriatric participant. Standard questions were provided as cues to facilitate IPC and teamwork, such as having the geriatric participant's condition/symptoms, the cultural background of the participant to be considered, current medication discussions, and participant environment considerations. The IPC between an assigned NP student and the DPT student was formally conducted and documented on Blackboard Discussion Board between the NP and DPT student pairs, and students utilized any comfortable means of communication needed in the process i.e. in person, by device, etc. Discussion board collaborations for Assignment 1 included objective scoring, considering both quality and frequency of communication, by the same evaluators (NP and DPT professor) using the Interprofessional Collaborator Assessment Rubric (ICAR), a tool to rate interprofessional competency devised by Curran et al. of the Academic Health Council.¹⁵ All students were provided the ICAR rubric for grading criteria prior to assignments. See appendix B to view the ICAR. The ICAR is designed to consider the four components of IPE as defined by the IPEC (values/ethics, roles and responsibilities, interprofessional communication, and teams/teamwork). Overall internal consistency reliability is .981, and interrater agreement is 91.5% with a 95% CI.¹⁶ Validity for the ICAR is not established at this time.

c. Assignment 2

The NP and DPT student pairs addressed a complex patient case requiring IPC to resolve polypharmacy and side effects experienced by the patient. Assignment 2 was scored by the ICAR once again and by the same evaluator as Assignment 1.

Data Collection

All DPT and NP students were assessed for content mastery via the following formative

evaluations:

1. Pre-course test, entitled the Interprofessional Collaboration Scale by Luecht et al. (1990), before studying IPC materials to assess baseline behaviors and use of IPC.¹⁷
2. Post-IPE module quiz of 15 questions emphasizing competence of the materials covered in the learning module in a. described above.
3. IPC post-course test using the Inteprofessional Collaboration Scale by Luecht. Et al (1990) evaluating the acquired knowledge and use of IPC by all students.¹⁷

Data Analysis

The software application SNAP Surveys was used to save and organize students' pre-test, post-test, quiz, assignments, and to collect and save data before and after training. The software, data, and web portal are fully secure "*https*" connections that encrypt both outgoing and incoming content. The software assigned each student an anonymous code, used to fill in and later to link the pre- and post-IPE training tests. The researchers analyzed data regarding students who completed IPE training and completed the test, quizzes, and assignments. Paired t-tests for independent samples were used to compare the pre- and post-tests of all the student participants. All data were stored in a database secured by passcodes to protect participant confidentiality and analyzed using the Statistical Package for the Social Sciences (SPSS) 18.0 software (Chicago, IL, USA).

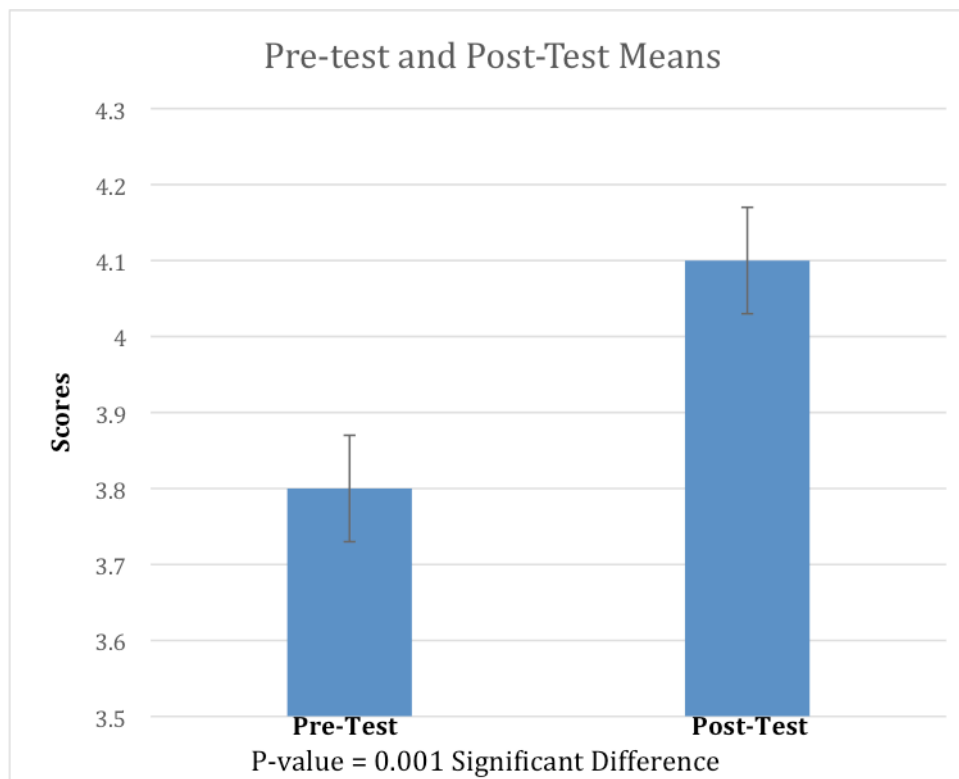
A paired t-test was completed to identify if there was a significant improvement from pre-test to post-test scores. Significance was determined by a p-value of $\leq .05$. A paired t-test was used for its ability to compare two nominal values from a within group design. Levene's Test was conducted for equality of variance.

A regression analysis was used to determine the best predictor of post-test scores, which served as the dependent variable. The regression allows the role of one variable to be isolated from all other variables in a design, requiring an analysis of multiple independent variables. A multiple regression analysis was performed for each of the identified factors as independent variables: profession, gender, age, assignment 1, assignment 2, pre-test, and prior GPA. The backward regression technique was used by removing the variables one at a time to establish which independent variable best anticipates post-test scores. Means and standard deviations were calculated for each of the independent variables for all participants, without any weighting for individual items. Intercorrelation coefficients between the factors were calculated using Pearson regression analyses. Significance was determined by a p-value of $\leq .05$.

RESULTS

A total of 43 consenting students participated in the pre-IPE test and the IPE training. However, 35 students, 81.4%, completed the study (N=24 DPT students; mean age $25.08 \pm 3.5y$, 10 males; N=11 NP students, mean age $37.6 \pm 8.0y$, 3 males). A total of 8 students were excluded from the study: 7 NP students and 1 DPT student failed to complete the post-test. A paired t-test was used to analyze pre- to post-IPE training score differences. The post-test mean of 4.10 (.38 SD, .069 SEM) was a statistically significant improvement over the pre-test mean of 3.84 (.41 SD, .07 SEM) after IPE training for both DPT and NP students. A p-value of .001 was noted. Figure 1 depicts the change of scores from pre-test to post-test for each participant. The IPE training produced significant improvements in behavioral outcomes and student awareness of IPC opportunities, which may lead to more collaborative approaches in their individual health care environments.

Figure 1: Pre-test and post-test means



The backward regression resulted in significant findings. When including Assignment 2 and pre-test scores together, the two were statistically significant in predicting post-test IPC scores. Likewise, pre-test scores alone were statistically significant in predicting post-test scores. Assignment 2 scores combined with pre-test scores explained 36% of the post-test scores (R Square value 0.361). Progressing through the backward regression by removing Assignment 2, pre-test scores predicted 27% of the post-test scores, making it the best single predictor of post-test scores (R Square value 0.268).

To further demonstrate improved understanding of IPC, participants provided reflections in a focus group. The purpose of the focus group was to discuss the efficacy of the collaboration and

IPE projects performed in the university setting. Comments on IPE gathered in the university setting included:

- “...simulation of real world experience were applicable to clinic and hospital settings.”
- “...benefits to patients regarding improved safety, quality outcomes, and continuity of care.”
- “...adds value to the healthcare professionals’ assessment process to include interdisciplinary correspondence.”

DISCUSSION

Based on the statistical analysis, significantly improved scores from the pre-test to post-test demonstrated that an increase in IPE behaviors and student awareness of IPC was achieved. This finding is encouraging because there is potential for teamwork collaborations in a primarily online application between nurse practitioners, as referral sources, and physical therapists, as movement and rehabilitation experts, which can result in more efficient and higher quality patient care outcomes.² This study is unique in that IPC is taught between practicing nurses, advancing their education to be nurse practitioners, and doctor of physical therapy students. The authors observed the pre-test scores to be significantly associated with the post-test scores via a correlation of 0.5, a moderate association. This finding may indicate that the greatest improvements in the behaviors and awareness of IPE comes from those who had some baseline experience with or respect for IPC prior to the IPE training. As found in previous studies, IPC results in improved patient satisfaction and patient involvement in healthcare decisions.¹⁷

Contrary to what the authors had predicted, there was no difference statistically regarding gender and its ability to predict IPC scores at this graduate school level. Based on the statistical

analysis, GPA was not the best predictor for post-test scores, albeit previous research showed GPA to be an important indicator for student performance.¹² The findings of the current study revealed that pre-test score was the best predictor for post-test score. In this study, the pre-test had the ability to identify those whose prior experience provided them a working concept of IPC, as opposed to general academic performance, which is reflected by those with higher prior GPA. This may explain why no significance in the ability of GPA to predict post-test scores was found. IPE and IPC may be most effectively presented to those who apply it in the actual medical care settings at the time it is learned. In combination with pre-test scores, Assignment 2 was found to have a significant impact on post-test scores. Assignment 2 had a greater IPC requirement than Assignment 1 between the DPT and NP students. This may have contributed to a better working knowledge, application, and understanding of IPE. As a result, Assignment 2 was a better predictor of post-test scores.

There were three noted themes throughout the focus group that enabled the participants to provide feedback regarding their IPE training experiences. Two positive themes of IPE included participant reports of effective collaboration between DPT and NP students and the opportunity to apply this knowledge to enable quality care for improved patient outcomes in their own health care settings. Students remarked that IPE “enabled team building of the patient’s assessment and plan of care,” leading to improved management of the patient throughout their medical care. Students also conveyed belief that IPE was “helpful to identify the areas in which NP and PT overlap in assessment abilities and the areas where strengths differ.” Such realizations may encourage a more efficient use of healthcare professionals’ time and allocation of patient healthcare funds. The final theme uncovered a disadvantage of the educational design of the research. Research has indicated that faculty are the key drivers in IPE addressing barriers and

resulting in a successful IPE program.¹⁸ However, positive results are observed by incorporating *outside* facilitators, which allow for an increase in IPE learning due to students benefiting from interactions *other* than strictly professors.¹³ Students suggested “it would be more effective to expand this experience into a clinical setting,” which would allow for an increase in clinical application of IPC. In addition, no negative feedback was received about course design for IPE learning as an online format. This is in agreement with previous studies suggesting that online training is equally beneficial in comparison to traditional face-to-face learning.^{10,11}

The results of this study indicate that implementation of IPE at the educational level between NP and DPT students may help to promote behaviors and awareness to increase utilization of IPC in their respective health care environments. Interprofessional collaboration has become increasingly important in efforts to reduce medical errors and improve patient safety and quality care. With online learning becoming increasingly popular, the results are encouraging for the application of IPE in this setting. Enhanced IPC will reduce service duplication, make better use of resources, and more effectively meet the complex needs of patients.⁹ Likewise nearly 80% of the students in the current study stated that they wanted to participate in *more* IPE experiences, regardless of their gender, during their feedback focus groups.

Study Limitations

Although the current study revealed pertinent information for NP and DPT student learning experiences in IPC, there were limitations to this study. One difficulty included the lack of post-IPE test responses from participants, resulting in an omission of these participants in the data analysis. Students noted that IPC experience following online IPE could have been more

natural, including more face-to-face IPC interaction for application of learned IPE. Another limitation for the study was that researchers allowed unlimited amounts of time for students to spend on each IPE learning module and assignment, so each participant's involvement in IPE learning may have varied. In addition, this study focuses on two health service entities in training at the graduate level, physical therapy and nurse practitioner students. In order to apply the current study's findings to the general population, future studies are needed at other higher education training levels and with additional health service professions.

CONCLUSION

The findings of this study emphasized the increased awareness and aim of students to utilize their acquired and applied knowledge of IPC following the implementation of online IPE training imbedded in an existing, course in DPT and NP student curriculum. The authors believe that improved assessment scores and positive focus group feedback, after online IPE training, is an initial step in identifying feasible opportunities to incorporate IPE effectively with the intended outcome of enhanced IPC in the clinical setting, efficiency among healthcare professionals, and improved patient satisfaction and outcomes.

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Appendix 1. Interprofessional Collaboration Scale

| DESCRIPTOR | Strongly Disagree 1 | Disagree 2 | Neither Agree or Disagree 3 | Agree 4 | Strongly Agree 5 |
|---|------------------------|---------------|--------------------------------|------------|---------------------|
| 1. I utilize other professionals in different disciplines for their particular expertise. | 1 | 2 | 3 | 4 | 5 |
| 2. Individuals in my profession are able to work closely with individuals in other professions. | 1 | 2 | 3 | 4 | 5 |
| 3. The colleagues from other disciplines with whom I work have a good understanding of the distinction between my role and their role(s). | 1 | 2 | 3 | 4 | 5 |
| 4. I can define those areas that are distinct in my professional role from that of professionals from other disciplines with whom I work. | 1 | 2 | 3 | 4 | 5 |
| 5. Professionals in different disciplines in my clinical setting utilize me for my expertise. | 1 | 2 | 3 | 4 | 5 |
| 6. I view part of my professional role as supporting the role of others with whom I work. | 1 | 2 | 3 | 4 | 5 |
| 7. I am optimistic about the ability of my colleagues from other disciplines to work with me to resolve problems. | 1 | 2 | 3 | 4 | 5 |
| 8. Individuals in my profession are willing to share information and resources with others in a straightforward manner. | 1 | 2 | 3 | 4 | 5 |
| 9. Protocols and new programs emerge from the cooperative work of different disciplines. | 1 | 2 | 3 | 4 | 5 |
| 10. Formal procedures/mechanisms exist for facilitating dialogue between professionals from different disciplines (ie, at staffings, inservice, rounds, etc). | 1 | 2 | 3 | 4 | 5 |
| 11. Working with colleagues from other disciplines leads to patient outcomes that could not be achieved alone. | 1 | 2 | 3 | 4 | 5 |
| 12. Professionals from other disciplines with whom I work encourage family members' participation in the treatment process. | 1 | 2 | 3 | 4 | 5 |
| 13. I utilize formal and informal procedures for problem-solving with my colleagues from other disciplines. | 1 | 2 | 3 | 4 | 5 |
| 14. I am willing to take on tasks outside of my job description to facilitate interprofessional collaboration. | 1 | 2 | 3 | 4 | 5 |
| 15. My colleagues from other disciplines work through conflicts with me in efforts to resolve them. | 1 | 2 | 3 | 4 | 5 |
| 16. When colleagues from different disciplines make decisions together they go through a process of examining alternatives. | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|--|---|---|---|---|---|
| 17. My interactions with colleagues from other disciplines occurs in a climate where there is freedom to be different and to disagree. | 1 | 2 | 3 | 4 | 5 |
| 18. Providers/patients/students all participate in interdisciplinary planning for optimal patient outcomes. | 1 | 2 | 3 | 4 | 5 |
| 19. My colleagues from other professions and I talk about ways to involve other professionals in our work together. | 1 | 2 | 3 | 4 | 5 |
| 20. My colleagues from other disciplines and I often discuss different strategies to improve our working relationships. | 1 | 2 | 3 | 4 | 5 |
| 21. I am able to work as a multidisciplinary team with others in clinical practice. | 1 | 2 | 3 | 4 | 5 |

References: Luecht et al, (1990). *Journal of Allied Health*, 181-191, with permission.
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Appendix 2. Interprofessional Collaborator Assessment Rubric Example for Collaboration/Teamwork (3 other domains of IPC scored were values/ethics of patient centered care, communication, and roles/responsibilities).

Collaboration/Teamwork: Ability to establish/maintain collaborative working relationships with other providers, patients/clients and families.

1. Establishes collaborative relationships with others in planning and providing patient/client care.
2. Promotes the integration of information from others in planning and providing care for patients/clients.
3. Upon approval of the patient/client or designated decision-maker, ensures that appropriate information is shared with other providers.

| Dimensions | Not Observable | Minimal 1 | Developing 2 | Competent 3 | Mastery 4 |
|---|----------------|---|--|--|--|
| <i>Patient/Client Input</i> | | Does not seek input from patient/client and family. | Occasionally seeks input from patient/client and family. | Frequently seeks input from patient/client and family. | Consistently seeks input from patient/client and family. |
| <i>Integration of Patient/Client Beliefs and Values</i> | | Does not integrate patient's/client's and family's circumstances, beliefs and values into care plans. | Occasionally integrates the patient's/client's and family's circumstances, beliefs and values into care plans. | Frequently integrates patient's/client's and family's circumstances, beliefs and values into care plans. | Consistently promotes and integrates patient's/ client's and family's circumstances, beliefs and values into care plans. |
| <i>Information Sharing with Patient/Client</i> | | Does not share options and health care information with patients/clients and families. | Occasionally shares options and health care information with patients/clients and families. | Frequently shares options and health care information with patients/clients and families. | Consistently shares options and health care information with patients/clients and families. |
| <i>Patient Advocacy in Decision- Making</i> | | Does not advocate for patient/client and family as partners in decision- making processes. | Occasionally advocates for patient/ client and family as partners in decision- making processes. | Frequently advocates for patient/client and family as partners in decision-making processes. | Consistently advocates for patient/client and family as partners in decision-making processes. |
| Comments: | | | | | |