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Review Article

Interprofessional education and distance education: A review and appraisal of the current literature

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ABSTRACT

Background: Interprofessional education (IPE) is becoming essential for students and healthcare professionals. An evolving approach to implement it is via distance education. Distance education can provide a viable solution to deliver IPE in a variety of settings.
Methods: A literature search on PubMed and Academic Search Complete databases was conducted, revealing 478 articles ranging from the years of 1971–2015. The articles were screened for relevance using the following inclusion criteria: 1) Is this study implementing IPE? 2) Is this study utilizing the instructional delivery method of distance education? 3) Does this study contain students from two or more healthcare professions?
Results: Fifteen studies met the inclusion criteria and were systematically analyzed to identify data relevant for this review. Findings from this review provide a description of the teaching methods involved in distance education in promoting IPE and an assessment of the continuing use of distance education to foster IPE. Success varied depending upon on the distance-based instructional model utilized to facilitate IPE.
Implications: Incorporating distance education to implement IPE can be an opportunity to develop team collaboration and communication skills among students. Teaching models presented in this review have the potential to be adapted to methods that leverage the power of evolving technology. Further research is needed to understand which distance education instructional delivery models best maximize the IPE experience.

Background

Interprofessional education (IPE) is defined as "two or more professions that learn with, from, and about each other to improve collaboration and quality of care".[1,2] Many accrediting bodies including the Commission on Collegiate Nursing Education, the Accreditation Council for Pharmacy Education, the Commission on Accreditation in Physical Therapy Education, and the Council on Education for Public Health hold themselves accountable by issuing directives or requirements aimed at specific IPE learner outcomes.[3] IPE uses a variety of interactive delivery methods, sometimes in combination with each other, including group problem

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solving, seminar-based discussions, and role playing activities.[2] In recent years, distance education has become another delivery method that adds to the repertoire of IPE.[1] Distance education is defined as "teaching and planned learning in which teaching normally occurs in a different place from learning, requiring communication through technologies".[4] E-learning is defined as the delivery of learning via any form of electronic media.[5] Synchronous and asynchronous technologies that could be employed for distance education include websites, podcasts, mobile applications, blogs, discussion boards, internet forums, interactive online tutorials, video conference technology, and virtual learning environments.[5] Although the literature provides examples of distance education for IPE, there is a lack of synthesis and critical appraisal of the evidence regarding the effectiveness of IPE using distance education. This article aims to provide a comprehensive review of the details of how distance education is relevant to IPE.

Methods

This literature review was undertaken to identify as many relevant studies as possible. Although the quality of studies in this review differ, meta-syntheses allow the evidence to be combined and evaluated to reach higher analytic goals and enhance the generalizability of qualitative research.[6]

Electronic searches on PubMed and Academic Search Complete databases were conducted to identify studies employing the search terms "interprofessional education" with each of the following: distance learning, distance education, e-learning, online learning, virtual patient, and simulation. This yielded 478 articles ranging from the years 1971–2015. The title, abstract, and, if needed, full text were screened for relevance using the following inclusion criteria: 1) Is this study implementing IPE?; 2) Is this study utilizing the instructional delivery method of distance education?; and 3) Does this study contain students from two or more healthcare professions? During this initial screening phase, only relevant citations were included.

Following the identification of relevant studies, we analyzed the evidence through a series of steps adapted from Reeves et al.[2] There are two major themes of interest for this analysis: to describe the teaching models employed through distance education to facilitate IPE for students, and to describe outcomes/results of examples of distance education and IPE.

Results

The findings are presented in three parts. An overview of the included studies is provided, followed by the two major themes of interest assembled from the findings.

Study overview

Fifteen studies were included in the final analysis based on the inclusion criteria (see Table 1).[7–21] The sample size varied from 11 to 620 participants with one article (Myers and O'Brien[9]) not reporting a sample size and included an array of disciplines such as but not limited to pharmacy, nursing, and medicine. Further details regarding each study are described in Table 1.

Theme 1. Teaching models employed through distance education to facilitate IPE.

Several different teaching models were utilized to facilitate IPE through distance education. King et al.[7] created an *Interprofessional Desktop* to build a learning community based on experiences from existing social networking. The *Interprofessional Desktop* was originally designed for a required interprofessional course consisting of nutrition, medicine, dentistry, dental hygiene, nursing, pharmacy, physical therapy, occupational therapy, and medical laboratory science students at the University of Alberta. In turn, these previous skills were used to build collaborations online for furthering professional practice. Clinical teams employed collaborative tools such as message boards and shared files to provide information rapidly to teammates and facilitators.[7] Santy et al.[8] used a "virtual town" to create an online student conference. This "virtual town" was a pilot project incorporating students in nursing, mid-wifery, operating department practitioner programs, and trainee endoscopists. These students were each in the second year of their respective three-year programs at the University of Hull. The learning management system Blackboard™ created a virtual learning environment to provide chat rooms and discussion boards for online communication and development.[8] The imaginary town was developed with a plethora of written materials providing social and demographic details about the local communities, where the students would practice.[8]

Myers and O'Brien[9] used Campus Pack (Learning Objects Inc., 2014) as an addition to Blackboard™ so occupational therapy, speech language pathology, and physical therapy students from the University of Kentucky and Eastern Kentucky University could participate together in the online portion of their early childhood and school-based practice courses. They utilized video conferencing to hold four synchronous meetings.[9] Ellman et al.[10] utilized an online case module to teach palliative care to medical, nursing, chaplaincy, and social work students who had prior clinical experience followed by a live workshop at Yale University. An embedded video showing an interprofessional team addressing the challenges of palliative care was included with the module.[10] McKenna et al.[11] had Monash University students from nursing, occupational therapy, physiotherapy, nutrition, and paramedic training placed into three focus groups to investigate students' perceptions on distance learning to facilitate interprofessional education. These students completed a linear series of documents and media, first defining interprofessional education and then defining individual professions and their role on the healthcare team, followed by a video of a healthcare team managing a patient.[11] Students could explore and share the information through focus groups and an online discussion forum.

Cartwright et al.[12] allocated students from speech pathology, health information management, social work, occupational therapy, and nursing into 10 interprofessional groups with a facilitator and utilized one fictional patient and one online dementia case to teach

Table 1
Summary of selected studies utilizing distance education to deliver IPE.

Study (year, site)	Design; sample size; student participants (disciplines)	Teaching model (s)	Outcomes	Results	Comments
King et al. (2009, Canada)[7]	Course Redesign; N = 620; (P, N, M, NT, D, OT, PT, DH, MLS, PER)	Collaborative asynchronous technology (*Interprofessional Desktop*, i.e. message boards and shared files)	Measured the overall use of the *Interprofessional Desktop* by students according to time spent on the desktop. Evaluation method: course management software	During week 1, students accessed the desktop for 225 h collectively. In weeks 2–4, usage dropped to between 78 and 86 collective hours. At week 5, the usage dropped further to 43 h.	Logistical complexity of incorporating technology into 5-week course; facilitators were not able to become completely fluid with the technology; students did not find the *Interprofessional Desktop* intuitive.
Santy et al. (2009, United Kingdom)[8]	Pilot Study; N = 330; (N, MW, E)	Virtual town consisting of an online student conference that allows learning to take place utilizing asynchronous discussion boards	Evaluated whether working online with students from other disciplines led to positive outcomes. Evaluation method: Final discussion forum. The paper pulled direct quotes from this forum.	Students at first were pessimistic but found the virtual town to be fun overall; students found it to be challenging to keep up with pace of discussion utilizing synchronous chat-rooms; some students found it less personal than being face-to-face; based on students' feedback, the authors suggests limiting the number of discussion threads to ensure steps in discussion were clear.	Discussion forum was essential as an online activity to enable them to become online learners; proficiency in working online together came about during their second year.
Myers et al. (2015, United States)[9]	Course Redesign; (OT, PT, speech pathology)	Interprofessional and intercollegiate asynchronous online learning with four synchronous meetings via interactive television across two institutions	Student feedback on quality of learning and working with other disciplines. Evaluation method: Written responses for self-directed learning activities in the course and by tracking individual participation.	Comments on gaining factual knowledge and being able to apply it in problem solving. Enhanced role in perceptions and communication.	Results self- reported; sample size not described in the article.
Ellman et al. (2012, United States)[10]	Mixed Methods; N = 217; (N, M, SW, chaplain)	Online interactive case based learning modules in palliative care	Evaluated five learning objectives of the IPE palliative care program. Evaluation method: Students' free-text responses to four reflections in the online case. Post workshop questionnaire with a 9 items scored on a 5 point likert scale as well as open-ended questions.	5 point Likert score rated by students was rated on all points > 4. Ranked responses between divinity, medical and nursing students. Rating of free response and questionnaire	Student responses to reflections
Mckenna et al. (2014, Australia)[11]	Mixed Methods; N = 45; (N, OT, PT, NT, paramedic)	Online web-based module to facilitate IPE	Health care professional students' perspectives on the value of using online delivery to facilitate IPE understandings and learning. Evaluation method: Interview transcripts	Reported outcomes that working interprofessionally online was a major benefit and allowed students to watch how other health professionals worked in a way that they otherwise would not have achieved in the clinical practice alone. Participants learned four main themes: 1. Professional understanding. 2. Patient centeredness. 3. Online module compared to other IPE activities. 4. Overcoming geographical boundaries.	Pilot study was conducted with students at one university in Australia and students were presented with only one clinical scenario.
Cartwright et al. (2013, Australia)[12]	Mixed Methods; N = 125; (Speech pathology, SW, OT, N, HI)	Asynchronous interprofessional groups with an online dementia case	Assessed students' values, attitudes, and learning outcomes. Evaluation method: Pre and Post survey using an adapted version of the ISVS.	N = 42 participants completed the Pre –questionnaire (Mean = 107.79, SD = 14.24) and Post-questionnaire (Mean = 115.62, SD = 13.80) with the ISVS scores. Mean improvement of 7.83 points ($p < 0.001$).	Low completion rate of questionnaire; disparate representation across disciplines

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Table 1 *(continued)*

Study (year, site)	Design; sample size; student participants (disciplines)	Teaching model (s)	Outcomes	Results	Comments
			Free text response to the question: In what ways has the collaboration with other students changed your thinking in terms of client centered care and approach to health care?	Qualitative results support interprofessional collaboration and patient centered care.	
Sabus et al. (2011, United States)[13]	Prospective survey; N = 69; (OT, PT)	Simulated virtual reality home environment	Outcome measure included: Interprofessional collaboration, patient centered decision making, appreciation of environmental and social context of functional mobility and occupational performance. Evaluation method: Web-based survey capturing student perception of the experience.	All groups produced recommendations that reflected higher levels of decision making in at least three of the four criteria. Most students agreed that the experience was supportive of the group interaction and interprofessional decision making.	Only 49% response rate to the survey.
Shoemaker et al. (2014, United States)[14]	Pre/Post; N = 72; (P, PA, PT)	Interprofessional team working on a virtual patient case education activity (experimental group) vs. didactic information only (control group)	Measured interprofessional competencies in pharmacy, physician assistant, and physical therapy graduate students. Evaluation method: Pre- and post- survey measurements on IPEC competencies and the RIPLS for control vs experimental group.	The experimental group had statistically significant improvement on a variety of IPEC competencies and RIPLS items. IPEC questions measuring interprofessional communication, collaboration, and confidence, & RIPLS questions measuring teamwork and collaboration, professional identity, and roles and responsibility were significantly improved with virtual patient case education.	Less than 40% of students in experimental group showed an improvement in survey scores.
Hall et al. (2011, Canada)[15]	Pilot study (Pre/Post); N = 20; (M, N, PT, spiritual care)	Web based learning module	Satisfaction questionnaire on spiritual, physical factors and need for interprofessional collaboration. Evaluation method: Pre/Post use of the ATHCTS	Questionnaire scores on factors of spiritual (pre = 10, post = 22), physical (pre = 25, post = 43), and interprofessional collaboration (pre = 2, post = 10) showed improvement.	Small sample size; three month follow-up students reported sustained value from the module, benefits of interprofessional teamwork and that they were applying the learning in clinical practice questionnaire not validated; technology was challenging for students and faculty.
Carbonaro et al. (2008, Canada)[16]	Mixed Methods; N = 49; (M, D, MLS, N, NT, OT, P, PT, PE)	Interprofessional team development course re-designed from face-to-face format to a blended learning format	Measured whether blended learning would be at least equal to traditional face-to-face delivery format on developing interprofessional team knowledge, skills and attitudes. Evaluation method: Pre-. Pre/post testing on The University of West England Interprofessional Questionnaire and The TOSCE.	No significant differences between face-to-face and online learning experiences regarding communication and teamwork skills, attitudes towards interprofessional learning, perception of interactions between different health professionals and perception of their relationships with health professionals from their own discipline and other disciplines. There was more positive perception of course achievement regarding	Small sample size; only 46 students completed the survey.

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Table 1 *(continued)*

Study (year, site)	Design; sample size; student participants (disciplines)	Teaching model (s)	Outcomes	Results	Comments
				enhancement of team process skills in the blended group.	
Solomon et al. (2010, Canada)[17]	Pilot study; N = 77; (N,OT,M)	Online IPE learning modules	Measured development of students' learning of what constituted interprofessional learning and collaborative group work. Evaluation method: Primarily qualitative through focus groups, interviews, analyses on off-line discussions and an online feedback form.	Qualitative results were collected via focus group or individual interviewing. Students reported that they learned about each other's roles and solved problems together and that they had positive perceptions of the IPE learning modules. Positive feedback and awareness of processes to move their learning teams forward were also noticed.	Less than 50% of students completed the study.
Shrader et al. (2016, United States)[18]	Pre/Post; N = 163; (N, P, M, OT, dietitian)	Telephone SBAR; MTM in Community Pharmacy; Online TOC	Measured students' satisfaction, attitudes, confidence, and performance related to interprofessional communication. Evaluation method: ATHCTS Pre- and post-survey measured the impact of alternative methods of communication simulations on students' attitudes, confidence, and performance related to interprofessional communication and collaboration.	Significant positive changes seen in 5 out 20 questions ($p < 0.05$).	Study used a psychometrically validated survey with an 81% response rate.
Solomon and Geddes (2010, Canada)[19]	Prospective, Qualitative; N = 11; (OT, M, PHY, N)	Asynchronous online IPE learning modules	Assessed whether students learned with, from, and about each other via e-learning on health care ethics. Evaluation method: Interviews and a focus group.	Qualitative results were collected via focus group and interviews. Based on students' comments, they were able to learn about each other's roles via e-learning.	Small sample size
Berg et al. (2010, United States)[20]	Mixed Methods; N = 16; (M, N)	Interprofessional SBAR training using remote technologies with manikin simulation	Assessed the feasibility of using remote technology to facilitate IPE. Evaluation method: remote educator using a checklist of observed communication strategies and post scenario student survey.	Student survey results reported improvement in students' communication skills.	Small sample size
McLeod et al. (2014, Canada)[21]	Pre/Post; N = 210; (M, N, PSY, SW, spiritual care)	Web-based course with videos, reading assignments, real-time seminars, and discussion boards	Evaluated 1) how an interprofessional, web-based course in PSO, influenced participants' knowledge, attitudes, and beliefs on this topic; 2) the attributes of a web-based platform that are most effective in delivering this course. Evaluation method: Pre/post self-report evaluating the change in interprofessional knowledge and attitudes.	There was a significant improvement on student's knowledge and attitudes when comparing pre-and post-survey results. Students reported the following: 1) the culture of their profession is very different compared to the other professions ($p < 0.05$); 2) they have an understanding of the roles of other professions ($p < 0.01$); 3) they feel confident interacting with interprofessional providers ($p < 0.05$); 4) they need to improve their interprofessional effectiveness ($p < 0.01$).	Results self-reported; study design lacked control group.

Abbreviations: ATHCTS (Attitude Toward Healthcare Teams Scale); D (Dentistry); DH (Dental Hygiene); E (Trainee Endoscopy); HI (Health Information Management); IPE (Interprofessional Education); IPEC (Interprofessional Education Collaborative); ISVS (Interprofessional Socialization and Valuing Scale); M (Medicine); MH (Mental Health); MLS (Medical Lab Science); MTM (Medication Therapy Management); MW (Mid-Wifery); N (Nursing); NT (Nutrition); OT (Occupational Therapy); P (Pharmacy); PA (Physician Assistant); PE (Physical Education); PER (Physical Education and Recreation); PHY (Physiotherapy); PM (Para-Medicine); PSO (Psychosocial Oncology); PT (Physical Therapy); PSY (Psychology); RIPLS (Readiness for Interprofessional Learning Scale); RT (Respiratory Therapy); SBAR (Situation, Background, Assessment, and Recommendation); SD (Standard Deviation); SW (Social Work); TOC (Transition of Care); TOSCE (Team Objective Standardized Clinical Examination).

students to work together in groups. New information was presented weekly over a four-week period to better reflect a true clinical experience and to allow students to spend time developing interactive problem solving experience and shared clinical reasoning skills.[12] Sabus et al.[13] used an online virtual world (Second Life®) to create a home to teach physical and occupational therapy students about barriers and challenges in the home environment and how to assess them. Shoemaker et al.[14] selected a diabetes case from an online virtual patient software (DxR Development Group, Carbondale, IL). Students from pharmacy, physician assistant, and physical therapy programs solved the case by working in interprofessional teams. The online case was utilized for one group in conjunction with regular coursework while a second group was not exposed to the case.[14]

Hall et al.[15] took students from medicine, nursing, physical therapy, and spiritual care to utilize "The Total Pain" module, an interactive narrative given from a patient's point of view, which students used to address issues of death and dying. Students completed the module and one synchronous meeting at the end of the class with video conferencing for students unable to be there in person.[15] Carbonaro et al.[16] at the University of Alberta redesigned an interprofessional team development course that included students from medicine, nursing, occupational therapy, pharmacy, physical therapy, medical laboratory science, dentistry, dental hygiene, and nutrition. These students were taught process skills necessary to work with other professions traditionally taught in a face-to-face format. Additionally, Carbonaro et al.[16] took an existing 100% face-to-face class and converted it into a blended teaching approach where 70% of instruction used both Elluminate (http://www.elluminate.com/) and WebCT.

Solomon et al.[17] took students from 10 professional programs as part of a consortium of four universities including McMaster University, University of Western Ontario, University of Ottawa, and Laurentian University as well as the Council of Ontario Universities (a provincial coordinating body) as part of the Institute of Interprofessional Health Sciences Education funded by Health Canada's IPE for Collaborative Practice Initiative. In this study, eight online modules were combined with group assignments and online discussion forums to solve cases to evaluate if asynchronous e-Learning could facilitate IPE. These modules were set specifically to use an instructor/facilitator to help strengthen group learning and interactions.[17]

Shrader et al.,[18] in an ambitious study, took pharmacy students and placed them with other health professional students in one of three interprofessional simulations utilizing either telephone, email, or video conferencing. During the telephone simulation, pharmacy and nursing students discussed a patient case via telephone using the situation, background, assessment, and recommendation (SBAR) format. In the medication therapy management (MTM) simulation, pharmacy and medical students created a patient care plan via e-mail communication. In the online transition of care (TOC), interprofessional students reviewed the electronic health record (EHR) and the audio recorded patient interview then discussed the patient case via a synchronous video conference as well as developed an interprofessional care plan in the EHR. Solomon and Geddes[19] implemented an online seven-week course focused on an interprofessional ethical decision-making model. Students from nursing, occupational therapy, and medicine participated in problem-based learning activities each week, which were provided in print or video clips, along with questions for reflections. Interprofessional students engaged in discussions via an online forum.[19]

Berg et al.[20] utilized remote technology to train nursing and medical students on the SBAR method. Nursing students collected information from the manikin patient and formulated a care plan along with medical students. Medical students presented the final case report to an on-site physician. Lastly, the students debriefed and were evaluated on their performance by the remote nurse educator. McLeod et al.[21] implemented the "Interprofessional Psychosocial Oncology Distance Education" project consisting of medical, nursing, social work, spiritual care, and psychology students spanning eight Canadian provinces to address the lack of coordination among health professionals in psychosocial oncology. This project consisted of a web-based platform course of real-time seminars, discussion boards, and multiple audio visual resources.[21] Real-time seminars were recorded and archived for students to watch at their convenience in case they missed a class or needed to review the content.

Theme 2. Outcomes/results of examples of distance education and IPE.

The review revealed many positive aspects of utilizing distance education. Santy et al.[8] found that their "virtual town" made IPE more "fun"; students felt it was more interesting than sitting in a classroom for three hours, and it gave everyone an opportunity to contribute. Students also found it easier to participate online through asynchronous discussion boards.[8] An alternative environment to the classroom led to the engagement and attention of students when the "virtual town" was utilized. The students in Myers and O'Brien[9] commented that their knowledge of other disciplines' roles on the healthcare team was greatly increased. Fundamentally, as stated by MacDonald et al.,[22] knowledge gained of other disciplines allows students to recognize and delineate their respective roles as part of a larger healthcare system.

Ellman et al.[10] found that students of all professions recognized the roles of other professions and the value of teamwork. This finding corroborates the findings of Myers and O'Brien[9] as well as creates goodwill in wanting to work as part of a larger team as these students transition into healthcare professionals. McKenna et al.[11] recognized that the use of videos allowed them to observe other members of the healthcare team in action which was difficult to do in clinical settings.[11] As indicated by Keller et al.[23] the opportunity to visually see an action versus reading about an action builds an appreciation for the skills other healthcare professionals possess, which subsequently builds trust in the abilities of other healthcare professionals. Healthcare professionals can leverage these skills amongst each other to ultimately benefit patients in real-world settings.

Cartwright et al.[12] reported an increase in interprofessional socialization, which may improve teamwork. This socialization, in turn, builds respect for each team member in potentially maximizing patient care, as pointed out by MacDonald et al.[22] Through virtual home simulation, Sabus et al.[13] found that physical therapy and occupational therapy students could interview a virtual patient and had to negotiate with the patient to make changes to the environment, such as adding a ramp to the rear of the house versus the front because it was better aesthetically to the patient. Changes to the virtual environment were performed through task-specific, functional client goals and home modification recommendations provided by interprofessional teams. The ability to interact

with the patient and the environment made learning more patient centered than previous scenarios, which were paper based in nature.[13] Shoemaker et al.[14] demonstrated that students' scores on validated questionnaires [Readiness for Interprofessional Learning Scale (RIPLS) and Interprofessional Education Collaborative (IPEC) Competency Self-Assessment Tool], improved with the addition of an interprofessional virtual patient activity as compared to receiving didactic coursework. The studies by Sabus[13] and Shoemaker[14] showed that creating a virtual patient and/or environment to work together and practice within can lead to inroads in the value of patient-centered medicine.

Students in the study by Hall et al.[15] gained positive benefits from the interprofessional teamwork experience in palliative care and indicated using this knowledge in clinical practice in a three-month follow-up. Carbonaro et al.[16] noticed no difference in face-to-face learning versus online learning regarding communication and teamwork skills amongst students, attitudes toward interprofessional learning, and perception of interactions with other healthcare professionals and healthcare professionals within their own discipline. This study suggests that learning outside of the classroom is effective for students to gain interprofessional skills especially if there are barriers to meeting face-to-face. Solomon et al.[17] found that as students solved problems together, it encouraged positive perceptions of the use of modules to promote interprofessional learning. The use of modules can give students the opportunity to learn at their own pace about different health professionals, which, in turn, can lead to successful teams. Students in the Shrader et al.[18] study reported that simulation improved interprofessional team communication positively impacting patient care. To practice on a simulated patient allows for trial and error as part of a team, which builds trust in other healthcare professionals' capabilities.[24] Solomon and Geddes[19] identified several themes when using online modules to facilitate IPE: sharing each other's perspectives, recognizing common goals, sharing resources amongst each other, and the uncertainty of interprofessional learning. The authors also reported that sometimes students had difficulty recognizing IPE components during discussion; therefore, facilitators played a key role in this study by asking students thought provoking questions and summarizing key issues that emerged from online discussions. Students in the Berg et al.[20] study reported the use of remote technology and simulation activity increased their comprehension and interest in interprofessional communication skills.[20] Similar results were observed by McLeod et al.,[21] where students completed distance-based interprofessional instruction and were asked to evaluate statements regarding their experience from 1 (strongly agree) to 5 (strongly disagree). When asked to evaluate the statement, “I learned a lot from students from health disciplines other than my own during this course” in the course evaluation, students agreed that distance-based interprofessional interaction improved their learning (mean = 2.10, mode = 2).[21] Additionally, students reported the interprofessional makeup of the small group and the use of discussion board contributed to their learning.

Studies have found some limitations to distance education to facilitate IPE. One common theme regarding the impact on students involved in distance IPE is the lack of personal contact.[8] Some students may prefer face-to-face learning over video or simulation for instance. Other challenges were related to the technology itself not being intuitive to the user.[7,8,15] Students in the study by King et al.[7] reported the program had too many layers or was cumbersome. Many stopped using the program because it was too frustrating.[7] Potentially, simplifying the technology to make it user-friendly would have translated to a better experience for all involved. There were issues with faculty development to facilitate online learning and the time involved for faculty facilitators was greatly increased.[7,9] Additionally, faculty in the Shrader et al.[18] study found that designing simulation and IPE activities requires more time than traditional lectures. Although it may be more time consuming to initially implement distance education, it may be easier to facilitate a simulation or online experience once it is in place. It was noted in some studies that technology did not always perform well.[7,8,15] Hall et al.[15] listed that the online content was not supported by all web browsers. A solution to this problem may be surveying the type of browsers students were using and troubleshooting each browser to ensure online content is supported. Lastly, McLeod et al.[21] found it challenging to include an assortment of professions within small groups. Most groups had plenty of nurse and social worker students, but less spiritual care specialist, psychologist, and medical students. McLeod et al.[21] also found it the most challenging to involve medical students due to their schedules and time limitations. Both issues suggest it may be a matter of re-structuring their respective programs to incorporate IPE and allowing distance education to facilitate the incorporation of students and maximize their limited time.

Implications

This meta-synthesis revealed that a wide selection of teaching models regarding distance education incorporated into IPE can be utilized including virtual towns, online learning communities, virtual interactive patients, synchronous and asynchronous group forums. In the studies listed, a variety of different levels of students were utilized. Santy et al.[8] incorporated students in their second year of professional school from a wide range of disciplines including nursing, midwifery, and trainee endoscopists. Distance education minimizes geographic barriers especially if healthcare students are from different schools or campuses. Students can learn at their own pace through distance education, which provides flexibility for students who may have a busier schedule while continuing to be involved in IPE. The importance of using distance education for IPE is to bring an assortment of different health professionals together to understand each other's disciplines. In turn, this understanding of the different roles of health care professionals will potentially translate into better teams and patient care. We found that there are multiple ways in which IPE can be implemented via distance education. Additional research could be performed to explore if a student's interaction with other students or healthcare professionals were to improve with additional training around IPE via a distance education method. Lastly, a suggestion for further research would be to perform a randomized trial incorporating the teaching methods Shoemaker et al.[14] used with two arms including a face-to-face course versus the same face-to-face course accompanied by an online virtual case. This would help clarify how students respond to distance education for IPE with face-to-face contact versus the lack of online content. The use of social networking as a model for distance education incorporating IPE by King et al.[7] showed that it may be difficult to implement it in a

learning environment. The use of social networking was an opportunity to develop team collaboration and communication skills among students.[7] For instance, *The Interprofessional Desktop* utilized was not as intuitive as *Facebook* thus leading to dissatisfaction.[7] Ultimately social networking could be implemented for team building purposes in an interprofessional setting that utilizes an established platform. Many aspects of social media make it an appealing option for interprofessional education for a multitude of reasons including near ubiquity, ease of use, inherent nature of an informal environment, and the hyper-connected mobile web environments, which can turn fragmented online conversations into meaningful outcomes.[25]

Solomon and Geddes[19] highlighted the importance of facilitators when using technology to facilitate IPE. This indicates that whether interprofessional students' discussions are synchronous, asynchronous or face-to-face, it is important to have a facilitator to monitor those interactions and intervene when necessary to correct any misunderstandings, engage students in deeper learning, and summarize key points.

Incorporating distance education to implement IPE is an essential component that has become apparent in the past few years. The advent of technology has created new teaching models with both benefits and limitations. Moreover, the current teaching models evaluated have the potential for the development of new models in the future. Further research is needed to definitively understand which distance education instructional delivery models can best maximize the IPE experience. As technology continues to improve, many avenues are left to explore and further the incorporation of IPE via distance education.

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