# Strategic Instructional Design of Interprofessional **Education in Health Professions Curricula**

Erin K. Breitenbach, A. T. Still University Susie L. Gronseth, University of Houston

Interprofessional education (IPE) brings together health care practitioners from different specialty areas to equip them with skills for cross-discipline collaborations. Viewed as integral to comprehensive patient care, interprofessional collaboration is receiving increased emphasis across health professions programs and has generated the need for strategic instructional design that integrates evaluation measures and matches IPE competencies with effective instructional approaches. The Content-Evaluation-Method (CEM) instructional design strategy is presented as a framework, along with examples, to guide the development of IPE curricula that incorporates and aligns key components of IPE content, evaluation considerations, and pedagogical methods.

instructional design, interprofessional education, health professions students, health professions practitioners, health professions education, team-based learning, role-playing, curriculum development, IPEC competencies, accreditation standards, evaluation, health care

Health professions curricula focus on the knowledge and skills health professions students and practitioners need to deliver quality health care. One important area that is increasingly working its way into health professions curricula across specialties is interprofessional education (IPE). IPE "occurs when students from different disciplines learn together" (Behan & Van Der Like, 2017, p. 225). It is a teaching and learning process where learning exists "about, from, and with" students or practitioners from two or more health professions (e.g., physicians, nurses, pharmacists) to equip them in the area of collaboration, which is linked to improved health outcomes (World Health Organization [WHO], 2010, p. 13). Ultimately, IPE instructional experiences need to not just provide opportunities for learners to work in teams, but they also need to guide learners to generate outcomes that reflect IPE core concepts of synergistic groupthink, shared understanding,

and team-based decision-making.

IPE has received increased attention in the medical community, as it is projected to play "a significant role in mitigating many of the challenges faced by health systems around the world" (WHO, 2010, p. 41). A key benefit of interprofessional collaboration is that it helps to reduce problems of fragmentation in health care delivery and separation among health care practitioners (Olenick, Allen, & Smego, 2010). IPE moves beyond professionspecific education by teaching health professions students and practitioners how to collaborate effectively with other health professionals, with the goal to improve patient safety and quality of care. Thus, developing collaboration skills among health professionals is an important curricular component for equipping them to provide coordinated patient care in a team environment (Buring et al., 2009). Many medical schools recognize the need for health professionals to develop collaboration skills,

as is evidenced by a tripling in the number of medical schools over the past 10 years that are now incorporating IPE into their curricula (Association of American Medical Colleges, 2019).

There are two major shifts that have fueled greater emphasis on IPE in recent years. First, effective collaboration among health professionals has been shown to enhance the quality of patient care, lower health care costs, decrease patient length of stay in a health care facility, and decrease medical errors (Knebel & Greiner, 2003). Second, the incorporation of IPE into curricula and training for health professions is increasingly gaining traction with accreditation agencies. In 2019, 24 accreditation agencies joined forces with the National Center for Interprofessional Practice and Education to produce Guidance on Developing *Quality Interprofessional Education for the* Health Professions (Health Professions Accreditors Collaborative & National Center for Interprofessional Practice and Education. 2019). Additionally, accreditors of most health professions (e.g., pharmacy, allopathic medicine, osteopathic medicine, physician assistant, physical therapy, audiology, speech language pathology) have included IPE in recent revisions of their accreditation standards to ensure that graduates have the competencies needed to function as members of interprofessional teams (Accreditation Commission for Audiology Education, 2016; Accreditation Council for Pharmacy Education, 2015; Accreditation Review Commission on Education for the Physician Assistant, Inc., 2018; Commission on Accreditation of Physical Therapy Education, 2017; Commission on Osteopathic College Accreditation, 2016; Council on Academic Accreditation in Audiology and Speech -Language Pathology, 2017; Liaison Committee on Medical Education, 2019).

To accommodate major shifts that have led to increased attention on IPE, great strides are being made in IPE learning experiences so that they effectively equip health professions students and practitioners to be able to collaborate with each other to achieve thorough, 360° patient care. In 2009, six national education associations for schools of various health professions (including the American Association of Colleges of Nursing, American Association of Colleges of Osteopathic Medicine, American Association of Colleges of Pharmacy, American Dental Education Association,

Association of American Medical Colleges, and the Association of Schools of Public Health) formed the Interprofessional Education Collaborative (IPEC) to advance interprofessional learning experiences that are focused on preparing future health care practitioners for team-based care of patients and ultimately improved population health outcomes (IPEC, 2011).

The IPEC (2011, 2016) created core competencies for interprofessional collaborative practice to guide curriculum development across health professions schools with the goal of increasing quality and safety in health care. There are four IPEC IPE core competency domains - values/ethics for interprofessional practice, roles/responsibilities, interprofessional communication, and teams and teamwork, and each of these domain areas contain specified sub-competencies (IPEC, 2016). Competency in values/ethics for interprofessional practice requires health care professionals to have a patient-centered focus within a community/population orientation. This focus is grounded within a shared purpose among the interdisciplinary team to support the common good in health care and to advance a "shared commitment to creating safer, more efficient, and more effective systems of care" (IPEC, 2011, p. 17). Health care professionals must also be competent in understanding how roles/responsibilities of other health care professionals complement each other in a community/population-oriented health care environment that is patient-centered. Role clarity can facilitate coordination of patient care and help to optimize the scope of practice for each member of the patient care team. Health care professionals must be competent in interprofessional communication to communicate responsively, collaboratively, and respectively with other health professionals in a health care team. Communication skills can relate to engaging effectively in verbal dialogue and discussion as well as enacting active listening and supportive nonverbal communicative gestures and expressions. Finally, they need to be competent in teams and teamwork so they can "[cooperate] in the patientcentered delivery of care; [coordinate] one's care with other health professionals so that gaps, redundancies, and errors are avoided; and [collaborate] with others through shared problem-solving and shared decision making" (IPEC, 2011, p. 24).

The guidance offered by the Health Professions Accreditors Collaborative and the National Center for Interprofessional Practice and Education targets the development and implementation of the core interprofessional competencies. However, medical schools are experiencing numerous challenges to implementing IPE, including "curriculum, leadership, resources, stereotypes, students' diversity, IPE concept, teaching, enthusiasm, professional jargons, and accreditation" (Sunguya, Hinthong, Jimba, & Yasuoka, 2014, p. 1). For example, finding the time and opportunity to schedule the implementation of IPE is a common challenge, but one solution has been to integrate IPE into the existing core curriculum instead of adding it as a separate course or program (Sunguya et al., 2014). Additionally, leadership challenges have included poor planning, lack of coordination and organization, and lack of interest or support by administrators (Sunguya et al., 2014). Thus, even though accreditation guidelines may now include IPE expectations, integrating IPE into curricula that has been historically separated due to the specialization of health care delivery has been met with resistance.

Some of the ways institutions are working to overcome these challenges include "commitment from departments and colleges, diverse calendar agreements, curricular mapping, mentor and faculty training, a sense of community, adequate physical space, technology, and community relationships" (Bridges, Davidson, Odegard, Maki, & Tomkowiak, 2011, p. 1). To address challenges fully, different facets of IPE instructional experiences need to be considered, including "the need for administrative support, interprofessional programmatic infrastructure, committed faculty, and the recognition of student participation as key components to success for anyone developing an IPE centered program" (ibid, p. 1).

Nonetheless, there are systemic drivers for incorporating IPE into health professions curricula, and many health professions schools are working to make changes to their curricula to achieve IPEC competencies. Though implementation of IPE seems to be widespread (Copley et al., 2007; Djukic, Fulmer, Adams, Lee, & Triola, 2012; MacDonnell, Rege, Misto, Dollase, & George, 2012; Marcel, 2005), "vast differences in IPE practices exist in health professions education" (West et al.,

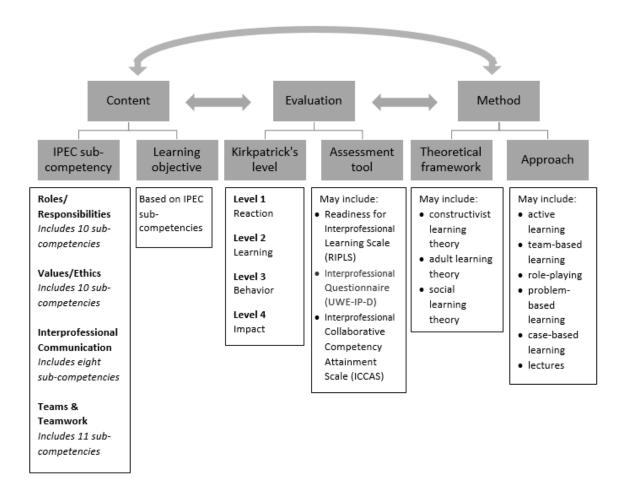
2016, p. 45). Instructional designers are challenged with not only incorporating IPE content into the curricula but also knowing which instructional approaches are effective for teaching IPE content and how to align IPE content, methods, and evaluation. Therefore, an instructional design strategy specifically crafted for IPE can support instructional design professionals working in health professions schools to be able to more consistently and comprehensively develop IPE curricula. This paper addresses this need by offering guidance for incorporating IPE into health professions curricula through an instructional design strategy that includes planning, implementing, and evaluating core components of IPE learning.

## **Developing an Instructional Design Strategy for IPE**

The term *instructional design strategy* is used in this paper to refer to a plan for aligning the key components of IPE content, evaluation considerations, and pedagogical methods (Figure 1). Henderson, O'Keefe, and Alexander (2010) suggest that an instructional design strategy for IPE should promote "effective communication, collaboration, and teamwork within health care settings to improve patient care and student learning outcomes" (p. 224). Delivery methods to accomplish this may vary, as do evaluation approaches. For example, at least 42 tools have been developed to evaluate IPE learning (Shrader, Farland, Danielson, Sicat, & Umland, 2017).

The Content-Evaluation-Method (CEM) instructional design strategy (see Figure 1) proposed in this paper aligns content that is first driven by learning objectives (based on IPEC sub-competencies), the selection of valid and reliable ways for evaluating the sub-competencies, and the utility of theoretically-based educational methods for teaching the sub-competencies. Each of the components of this strategy will be described briefly.

Figure 1. CEM alignment instructional design strategy for developing IPE



#### Content

The core of the CEM instructional design strategy for the development of IPE curricula is the *content* that is based on the 39 IPEC sub-competencies within the four IPE domains of values/ethics for interprofessional practice, roles/responsibilities, interprofessional communication, and teams and teamwork (IPEC, 2016). Designers first select the targeted IPEC sub-competencies and then draft learning objectives to align with those sub-competencies (Gunaldo, Brisolara, Davis, & Moore, 2017). The learning activities are then developed in alignment with the IPECgrounded learning objectives to support learner development of knowledge and skills identified in the IPEC sub-competencies. Designers can map IPEC sub-competencies to learning objectives and learning activities and build in several IPE options to ensure competency coverage (West et al., 2015). Comprehensive IPE programs would ultimately address all IPEC sub-competencies at some point in the completed program curricula.

The *iCATS* (Interprofessional Collaboration and Team Skills) program is an example of a successful IPE curriculum that mapped learning objectives and learning activities to IPEC sub-competencies (Woltenberg & Taylor, 2018). The program was developed at the University of Kentucky and serves as the core interprofessional curriculum for seven of their health professional programs. iCATS addresses various IPEC sub-competencies through experiential learning approaches. One session, for instance, includes a simulation activity in which learners enact the *PEEER* (Plain Language, Engagement, Empathy, Empowerment, Respect) model (see Conigliaro, Kuperstein, Dupuis, Welsh, & Taylor, 2013). The activity is designed to address development of sub-competencies in the IPEC domains of teams and teamwork and interprofessional communication.

#### **Evaluation**

Evaluation is a recommended component of IPE curricular design that can offer added value when developed from the outset and used to guide decision-making throughout implementation (Anderson, 2016). It should be noted that there is currently not a broadly accepted, valid and reliable way to measure the effectiveness of IPE on patient outcomes (Dow, DiazGranados, Mazmanian, & Retchin, 2014; Institute of Medicine, 2015). Further, while connecting long-term outcomes to IPE learning experiences is ideal, there are methodological challenges to long-term observation of learners, such as changes in learners' areas of clinical practice after the IPE training. Thus, in the area of IPE curriculum development, there tends to be a reliance on shortterm measurements of effectiveness and the drawing from theoretical grounding of instructional design practices used for the development of curricula in other content areas.

Many IPE programs that report on evaluation aspects incorporate Kirkpatrick's training evaluation model (e.g., Reeves, Boet, Zierler, & Kitto, 2015). Use of this model could be due in part to its intuitive application in the categorization of IPE outcomes (Committee on Measuring the Impact of Interprofessional Education on Collaborative Practice and Patient Outcomes; Board on Global Health; Institute of Medicine, 2015). Kirkpatrick viewed the evaluation of educational outcomes at four levels - reaction, learning, behavior, and impact (Kirkpatrick, 1979; Kirkpatrick & Kirkpatrick, 2006, 2007). Related to the evaluation of IPE, reaction level measures may include learner satisfaction with and perceptions of the interprofessional nature of an educational program. Learning level measures determine the extent of learners' understanding related to learning objectives, their attitudes regarding the enactment of team approaches, and their developed interprofessional skills. Behavior level measures determine the extent that learners apply what they have learned in an IPE learning experience to their practice in a health professions setting. *Impact* level measures are the long-term considerations of changes to organizational practice and patient, family, and community outcomes that can be directly connected back to an IPE program. Deciding what to evaluate and at what levels involves identifying stakeholder priorities regarding evaluation data and considering

the availability of resources (including people, time, and budget) that would be needed to complete the evaluation (Kirkpatrick & Kirkpatrick, 2007).

The National Center for Interprofessional Practice and Education (2018) lists 50 measurement tools that can be used to evaluate IPE at one or more of the Kirkpatrick evaluation levels. These tools can be used to support evaluation of individual, team, and organization-wide IPE programs. IPE evaluation instruments are also available from the Canadian Interprofessional Health Collaborative (2012) and the Harvard Business School (Valentine, Nembhard, & Edmondson, 2011). Most IPE evaluation instruments assess outcomes as attitudes (primarily within the Kirkpatrick's evaluation level 2 [learning]), though several instruments have been developed for assessing outcomes at more than one outcome level (typically levels 1 [reaction] and 2 [learning]) (Blue, Chesluk, Conforti, & Holmboe, 2015).

#### Method

Tennyson (2010) speaks of the importance of grounding design in related theory when he argues for the "explicit placement of educational foundations into the methodology of instructional systems design" (p. 13). The CEM instructional design strategy values the utility of learning and instructional theory as foundational to IPE learning experiences, and it guides designers to consider relevant theoretical frameworks as they develop IPE curricula. By situating the design of IPE learning activities within related theoretical frameworks, designers will be able to articulate their rationale for selected instructional approaches in the IPE curricula and use the selected theories to scaffold their application of associated teaching methods (Hean, Craddock, Hammick, & Hammick, 2012; Sargeant, 2009). IPE pedagogical approaches that have been found to be effective in terms of student learning outcomes include those that "maximize opportunities for interaction" (Reeves, Goldman, & Oandsan, 2007, p. 232) and that "engage students in teams and are conducive to role exploration, application of various communication techniques and 'hands-on' team development" (West et al., 2016, p. 44).

Though there are numerous relevant theoretical frameworks, social learning theory and active learning are particularly key for IPE. Social learning theory posits that people

learn from each other through observation, imitation, and modeling (Bandura, 1977). Cognitive components of self-regulation, attention, and control are considered important elements of the process as learners acquire target knowledge and skills within a health care environment (Braungart, Braungart, & Gramet, 2020). For example, in IPE, social learning grounds the instructional approach of role modeling in which more experienced health professionals could demonstrate for learners how they communicate their roles and responsibilities to other members of a patient care team (roles/responsibilities subcompetency 1). Active learning is a pedagogical approach in which students actively construct their knowledge (Carr, Palmer, & Hagel, 2015; West et al., 2016). Active learning is based on constructivist learning theory, in which individuals actively construct knowledge by connecting new knowledge with existing knowledge (Bransford, Brown, & Cocking, 1999). Contrasted with behaviorism and associated direct instruction approaches (such as lecture) in which learners are viewed as receivers of information, active learning promotes learner involvement through discussion, writing, application of higher-order thinking skills such as synthesis, problem-solving, and interactions with others. An active learning-grounded IPE activity could involve a role-play discussion in which learners take on specific roles that reflect different values and goals and enact how they would navigate the contrasting views within their team to reach a consensus regarding a patient care decision (teams & teamwork subcompetency 6).

## Applying the CEM Instructional Design Strategy

The intention of the CEM instructional design strategy is that it can be used to develop any format of IPE, ranging from a single module that covers only one IPEC subcompetency to a full-day workshop that covers several IPEC sub-competencies to an entire curriculum that spans all 39 IPEC subcompetencies. As a starting point, designers are advised to first select the IPEC subcompetencies that will be targeted in the proposed instruction (i.e., the *content*). Then, designers work through the *evaluation* and *method* components in order to ensure development

of a comprehensive IPE curriculum. Two instructional methods that present considerable promise for interprofessional learning are team-based learning ([TBL] Chan et al., 2017; Jorm et al., 2016; Lochner et al., 2018; Nisbet, Gordon, Jorm, & Chen, 2016; Quesnelle, Bright, & Salvati, 2018; Sisk, 2011) and role-playing (Adrian, Zeszotarski, & Ma, 2015; Awad et al., 2005; Christopher et al., 2019; Sargeant, MacLeod, & Murray, 2011; Shortridge et al., 2019; Villadsen, Allain, Bell, & Hingley-Jones, 2012). Examples from the literature involving TBL and role-playing in IPE initiatives will be presented through the lens of the CEM instructional design strategy to demonstrate how designers can align content, evaluation, and methods in IPE curriculum (see Appendix A CEM alignment instructional design steategy for developing IPE). The reader should note that some CEM components are identified specifically by the authors of the IPE examples, and other components are inferred implicitly for demonstration purposes.

The teamwork focus of TBL corresponds to the collaborative nature of IPE. making it a suitable pedagogical choice for many IPE initiatives (Michaelson, Knight, & Fink, 2002). TBL structures learning activities within small groups of 5-7 learners (Sisk, 2011; Team-Based Learning Collaborative, n.d.), requires interactions among learners, involves scenario-based learning, and incorporates adult learning principles (Chan et al., 2017). TBL has been shown to improve content knowledge (Quesnelle et al., 2018), perceptions of interprofessional collaboration (Lochner et al., 2018; Quesnelle et al., 2018), mutual understandings of expertise of health care professionals in other disciplines (MacDonnell et al., 2012), teamwork effectiveness (MacDonnell et al., 2012), and readiness for interprofessional learning (Chan et al., 2017; Lochner et al., 2018). The building of realistic case scenarios that engage all of the participating health care professions is a critical element of TBL application in IPE (Jorm et al., 2016; Lochner et al., 2018; Nisbet, Gordon, Jorm, & Chen, 2016).

One example of an IPE initiative using TBL is Lochner and colleagues' (2018) three-day InterProfessional Education in Patient Safety (iPEPS) course designed for health professions students from five different health

professions programs (nursing, dietetics and nutrition, occupational therapy, radiology techniques, and laboratory techniques). Learning objectives include learners' reflections on their attitudes toward critical incidents and how these are managed interprofessionally, recognition of the varied perspectives and roles within an interprofessional team, and completion of a critical incident report form with an interprofessional team ((see Appendix A CEM alignment instructional design steategy for developing IPE). In reviewing Lochner et al. (2018), evaluation at three Kirkpatrick levels are apparent – student reaction to TBL, attitudes toward IPE, and behavior in terms of individual performance and team performance. Assessment tools include Team-Based Learning Student Assessment Instrument (TBL-SAI), Interprofessional Questionnaire (UWE-IP-D), Individual Readiness Assurance Test (IRAT), and Group Readiness Assurance Test (GRAT).

The iCATS program mentioned earlier is another example of an IPE initiative that facilitates IPE learning experiences using a TBL instructional approach (Woltenberg & Taylor, 2018). iCATS learning objectives connect to several IPEC sub-competencies from each of the IPEC domains. The program is designed as an embedded learning experience within an existing required course that is part of seven different health professions programs at the university. Appendix A identifies several of the IPEC sub-competencies and their corresponding learning objectives and evaluation measures from the iCATS curriculum.

Educators have also experienced success in using role-playing as a way to teach IPE (e.g., Awad et al., 2005; Villadsen et al., 2012). Role-playing has been used in interprofessional workshops and communications skills courses to provide health professions students of different disciplines opportunities to practice communication skills. Results from recent studies on IPE initiatives involving role -play include the cultivation of more positive views towards IPE (Villadsen et al., 2012), communications skills improvements (Awad et al., 2005; Sargeant et al., 2011), enhanced appreciation and knowledge of effective oral communication (Adrian, Zeszotarski, & Ma, 2015), improved outlooks on teamwork and roles within the health care system (Christopher et al., 2019), and positive responses from patients (Sargeant et al., 2011).

Online modules and handouts can support role -play activities by providing learners with necessary foundational knowledge of IPE that they can use to more fully engage in the immersive learning experience (McKee, D'Eon, & Trinder, 2013).

Christopher and colleagues (2019) provide an example of an IPE initiative for pharmacy and physician assistant students that uses role-play. The learners were first provided with handouts to aid in their understanding of each other's roles, and then the teaching faculty explained the role-play case scenario. The team-based role-playing case provided each student with opportunities to practice his/her own discipline and observe the other discipline as s/he played the part of a mock patient. Two of the four learning objectives focused on IPEC sub-competencies in the domains of roles/responsibilities and teams and teamwork. The Readiness for Interprofessional Learning Scale (RIPLS) survey was used to evaluate attitudes about teamwork, collaboration, and IPE (an evaluation at Kirkpatrick's level 2 [learning]).

#### Conclusion

The examples presented in this article illustrate how the CEM instructional design strategy frames alignment among content, evaluation, and methods in recent IPE initiatives. Instructional design strategies like the CEM are useful for structuring the design of IPE curricula so that they provide students with meaningful experiences that enhance their understanding of the roles and values of health care professionals in other specialty areas and help them to collaborate with colleagues from these areas more effectively. Developing curricula that support engagement with and mastery of the IPEC core competency domains of values/ethics for interprofessional practice, roles/responsibilities, interprofessional communication, and teams and teamwork is an important step in equipping health care practitioners to reduce health care delivery fragmentation and provide more comprehensive 360° patient care. It is recommended that instructional designers use CEM to guide development of robust IPE learning experiences so that learning objectives, evaluation components, and pedagogy are planned strategically and comprehensively to address specified IPEC sub-competencies.

### References

- Accreditation Commission for Audiology Education. (2016). A ccreditation standards for the doctor of audiology (Au.D.) program. Retrieved from https://acaeaccred.org/standards/
- Accreditation Council for Pharmacy
  Education. (2015). A ccreditation
  standards and key elements for the
  professional program in pharmacy
  leading to the doctor in pharmacy
  degree: Standards 2016. Retrieved
  from https://www.acpe-accredit.org/
  pdf/Standards2016FINAL.pdf
- Adrian, J. A. L., Zeszotarski, P., & Ma, C. (2015). Developing pharmacy student communication skills through role-playing and active learning. *A merican Journal of Pharmaceutical Education*, 79(3), 1-8. https://doi.org/10.5688/ajpe79344
- Anderson, E.S. (2016). Evaluating interprofessional education: An important step to improving practice and influencing policy. *Journal of Taibah University Medical Sciences*, 11(6), 571-578. https://doi.org/10.1016/j.jtumed.2016.08.012
- Association of American Medical Colleges. (2019). Required interprofessional education: Schools requiring the program. Retrieved from https://www.aamc.org/initiatives/cir/403572/02.html
- Awad, S. S., Fagan, S. P., Bellows, C., Albo, D., Green-Rashad, B., De La Garza, M., & Berger, D. H. (2005). Bridging the communication gap in the operating room with medical team training. *The American Journal of Surgery*, 190, 770-774. https://doi.org/10.1016/j.amjsurg.2005.07.018
- Bandura, A. (1977). *Social learning theory*. New York: General Learning Press.
- Behan, K. J. & Van Der Like, J. (2017). Introducing interprofessional education to BSN and CLS students using a simulated healthcare setting. *Clinical Laboratory Science*, 30(4), 224-227.
- Blue, A. V., Chesluk, B. J., Conforti, L. N., & Holmboe, E. S. (2015). Assessment and evaluation in interprofessional

- education exploring the field. *Journal* of Allied Health, 44(2), 73-82.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (1999). How people learn:

  Brain, mind, experience, and school.

  Washington, D.C.: National Academy Press.
- Braungart, M. M., Braungart, R. G., & Gramet, P. R. (2020). Applying learning theories to healthcare practices. In S. B. Bastable, P. R. Gramet, D. L. Sopczyk, K. Jacobs, & M. M. Braungart (Eds.), *Health professional as educator: Principles of teaching and learning* (2<sup>nd</sup> ed., pp. 75-126). Burlington, MA: Jones & Bartlett Learning.
- Bridges, D. R., Davidson, R. A., Odegard, P. S., Maki, I. V., & Tomkowiak, J. (2011). Interprofessional collaboration: Three best practice models of interprofessional education. *Medical education online*, *16*. https://doi.org/10.3402/meo.v16i0.6035
- Buring, S. M., Bhushan, A., Broeseker, A., Conway, S., Duncan-Hewitt, W., Hansen, L., & Westberg, S. (2009). Interprofessional education: Definitions, student competencies, and guidelines for implementation.

  American Journal of Pharmaceutical Education, 73(4), 1-8.
- Canadian Interprofessional Health
  Collaborative. (2012, August). An
  inventory of quantitative tools
  measuring interprofessional education
  and collaborative practice outcomes.
  Retrieved from https://
  heller.brandeis.edu/relationalcoordination/pdfs/canadianinterprofessional-health-collaborativereport.pdf.
- Carr, R., Palmer, S., & Hagel, P. (2015).
  Active learning: The importance of developing a comprehensive measure.

  Active Learning in Higher Education 16, 173-186. https://doi.org/10.1177/1469787415589529
- Chan, L. K., Ganotice, F., Jr, Wong, F. K. Y., Lau, C. S., Bridges, S. M., Chan, C. H. Y., ... Yum, T. P. (2017). Implementation of an interprofessional team-based learning program involving seven undergraduate health and social care programs from two universities,

- and students' evaluation of their readiness for interprofessional learning. BMC Medical Education, 17 (1), 221. https://doi.org/10.1186/ s12909-017-1046-5
- Christopher, A., Hammett, L., Fischer, K., Peters, D., Laswell, E., Gryka, R., Harper, N., & Stute, N. (2019). Anemia interprofessional team role-play case for students in outpatient primary care. Journal of Interprofessional Education & Practice, 16, 1-5. https:// doi.org/10.1016/j.xjep.2019.100266
- Commission on Accreditation of Physical Therapy Education. (2017). Standards and required elements for accreditation of physical therapist education programs. Retrieved from http://www.capteonline.org/ uploadedFiles/CAPTEorg/ About CAPTE/Resources/ Accreditation Handbook/ CAPTE PTStandardsEvidence.pdf
- Commission on Osteopathic College Accreditation. (2016). Accreditation of colleges of osteopathic medicine: COM accreditation standards and procedures. Retrieved from https:// osteopathic.org/wp-content/ uploads/2018/02/com-accreditationstandards-8-29-2016.pdf
- Committee on Measuring the Impact of Interprofessional Education on Collaborative Practice and Patient Outcomes; Board on Global Health; Institute of Medicine. (2015, December 15). Measuring the impact of interprofessional education on collaborative practice and patient outcomes: Conceptual framework for measuring the impact of IPE. Washington, D. C.: National Academies Press. Retrieved from: https://www.ncbi.nlm.nih.gov/books/ NBK338356/
- Conigliaro, R., Kuperstein, J., Dupuis, J., Welsh, D., & Taylor, S. (2013). The PEEER model: Effective healthcare team-patient communications. *MedEdPORTAL*, 9. https:// doi.org/10.15766/mep 2374-8265.9360
- Council on Academic Accreditation in Audiology and Speech-Language Pathology. (2017). Standards for

- accreditation of graduate education programs in audiology and speechlanguage pathology. Retrieved from https://caa.asha.org/wp-content/ uploads/Accreditation-Standards-for-Graduate-Programs.pdf
- Copley, J. A., Allison, H. D., Hill, A. E., Moran, M. C., Tait, J. A., & Day, T. (2007) Making interprofessional education real: A university clinic model. Australian Health Review, 31, 351-357. https://doi.org/10.1071/ AH070351
- Djukic, M., Fulmer, T., Adams, J. G., Lee, S., & Triola, M. M. (2012). NYU3T: Teaching, technology, teamwork, Nursing Clinics, 47(3), 333-346. https://doi.org/10.1016/ i.cnur.2012.05.003
- Dow, A. D., DiazGranados, D., Mazmanian, P. E., & Retchin, S. M. (2014). An exploratory study of an assessment tool derived from the competencies of the interprofessional education collaborative. Journal of Interprofessional Care, 28(4), 299-304. https://doi.org/10.3109/13561820. 2014.891573
- Fink, L. D., Knight, A. B., & Michaelsen, L. K. (2002). Team-Based Learning: A transformative use of small groups. Westport, CT: Praeger.
- Gunaldo, T. P., Brisolara, K. F., Davis. A. H., & Moore, R. (2017). Aligning interprofessional education collaborative sub-competencies to a progression of learning. Journal of Interprofessional Care, 31(3), 394-396. https://doi.org/10.1080/ 13561820.2017.1285273
- Health Professions Accreditors Collaborative & National Center for Interprofessional Practice and Education. (2019). Health Professions Accreditors Collaborative and National Center for Interprofessional Practice and Education Develop Guidance to *Improve the Quality of IPE for the* Health Professions [Press Release]. Retrieved from https:// healthprofessionsaccreditors.org/wpcontent/uploads/2019/02/ HPACPressReleaseFinal.pdf
- Hean, S., Craddock, D., & Hammick, M. (2012). Theoretical insights into

- interprofessional education. *Medical Teacher*, *34*(2), 158–160. https://doi.org/10.3109/0142159X.2012.650740
- Henderson, A. J., O'Keefe, M. F., & Alexander, H. G. (2010).
  Interprofessional education in clinical practice: Not a single vaccine.

  Australian Health Review: A
  Publication of the Australian Hospital
  Association, 34(2), 224-226. https://doi.org/10.1071/AH09855
- Institute of Medicine (2015). Measuring the Impact of Interprofessional Education on Collaborative Practice and Patient Outcomes. Washington, DC: The National Academies Press.
- Interprofessional Education Collaborative. (2011). Core competencies for interprofessional collaborative practice. Washington, DC: Interprofessional Education Collaborative.
- Interprofessional Education Collaborative. (2016). Core competencies for interprofessional collaborative practice: 2016 update. Washington, DC: Interprofessional Education Collaborative.
- Jorm, C., Nisbet, G., Roberts, C., Gordon, C., Gentilcore, S., & Chen, T. F. (2016). Using complexity theory to develop a student-directed interprofessional learning activity for 1220 healthcare students. *BMC Medical Education*, 16, 199. https://doi.org/10.1186/s12909-016-0717-y
- Kirkpatrick, D. L. (1979). Techniques for evaluating training. *Training & Development Journal*, 33(6), 78-92.
- Kirkpatrick, D. L., & Kirkpatrick, J. D. (2006). *Evaluating training programs:* The four levels. (3<sup>rd</sup> ed.). San Francisco: Berrett-Koehler Publishers, Inc.
- Kirkpatrick, D.L., & Kirkpatrick, J. D. (2007). Implementing the four levels: A practical guide for effective evaluation of training programs. San Francisco: Berrett-Koehler Publishers, Inc.
- Knebel, E., & Greiner, A. (2003). *Health* professions education: A bridge to quality. Washington, D.C.: National Academies Press.
- Liaison Committee on Medical Education.

- (2019). Functions and structure of a medical school: Standards for accreditation of medical education programs leading to the MD degree. Retrieved from http://lcme.org/publications/#Standards
- Lochner, L., Girardi, S., Pavcovich, A., Meier, H., Mantovan, F., & Ausserhoffer, D. (2018). Applying interprofessional team-based learning in patient safety: A pilot evaluation study. *BMC Medical Education*, 18(1), 1-9. https://doi.org/10.1186/s12909-018-1164-8
- Marcel, D. (2005). A blueprint for interprofessional learning. *Journal of Interprofessional Care*, 19(1), 49-59. https://doi.org/10.1080/13561820512331350227
- MacDonnell, C. P., Rege, S. V., Misto, K., Dollase, R., & George, P. (2012). An introductory interprofessional exercise for healthcare students. *American Journal of Pharmaceutical Education*, 76 (8), 1-6. https://doi.org/10.5688/ajpe768154
- McKee, N., D'Eon, M., & Trinder, K. (2013). Problem-based learning for inter-professional education: Evidence from an inter-professional PBL module on palliative care. *Canadian Medical Education Journal*, 4(1), e35–e48.
- Michaelsen, L. K., Knight, A. B., & Fink, L. D. (2002). *Team-based learning: A transformative use of small groups*. Westport, CT: Praeger Publishers.
- National Center for Interprofessional Practice and Education. (2018). *Assessment and evaluation*. Retrieved from https://nexusipe.org/advancing/assessment-evaluation
- Nisbet, G., Gordon, C. J., Jorm, C., & Chen, T. (2016). Influencing student attitudes through a student-directed interprofessional learning activity: A pilot study. *International Journal of Practice-Based Learning in Health Social Care*, 4, 1–15.
- Olenick, M., Allen, L. R., & Smego, R. A., Jr (2010). Interprofessional education: A concept analysis. *Advances in Medical Education and Practice*, 1, 75–84. https://doi.org/10.2147/AMEP.S13207
- Quesnelle, K. M, Bright, D. R., & Salvati, L.A. (2018). Interprofessional education through a telehealth team

- based learning exercise focused on pharmacogenomics. Currents in Pharmacy Teaching and Learning, 10 (8), 1062-1069. https:// doi.org/10.1016/j.cptl.2018.05.015
- Reeves, S., Goldman, J. & Oandsan, I. (2007). Key factors in planning and implementing interprofessional education in health care settings. Journal of Allied Health, 36(4), 231-235.
- Reeves, S., Boet, S., Zierler, B., & Kitto, S. (2015). Interprofessional education and practice guide no. 3: Evaluating interprofessional education. Journal of Interprofessional Care, 29(4), 305– 312. https:// doi.org/10.3109/13561820.2014.10036 37
- Sargeant, J. (2009). Theories to aid understanding and implementation of interprofessional education. The Journal of Continuing Education in the *Health Professions*, 29(3), 78-84. https://doi.org/10.1002/chp.20033
- Sargeant, J., MacLeod, T., & Murray, A. (2011). An interprofessional approach to teaching communication skills. Journal of Continuing Education in the *Health Professions*, 31(4), 265-267. https://doi-org.ezproxy.lib.uh.edu/ 10.1002/chp.20139
- Shortridge, A., Steinheider, B., Bender, D. G., Hoffmeister, V. E., Ciro, C. A., Ross, H. M., Randall, K., & Loving, G. (2019). Teaching and evaluating interprofessional teamwork using sequenced instruction and Team-STEPPS<sup>TM</sup> Team Performance Observation Tool (TPOT). Journal of Interprofessional Education & *Practice*, 16, 1-4. https:// doi.org/10.1016/j.xjep.2019.01.009
- Shrader, S., Farland, M., Danielson, J., Sicat, B., & Umland, E. (2017). A systematic review of assessment tools measuring interprofessional education outcomes relevant to pharmacy education. American Journal of Pharmaceutical Education, 81(6), 119.
- Sisk, R. J. (2011). Team-Based Learning: Systematic research review. Journal of *Nursing Education*, *50*(12), 665-669. https://doi.org/10.3928/01484834-20111017-01

- Sunguya, B. F., Hinthong, W., Jimba, M., & Yasuoka, J. (2014). Interprofessional education for whom? --challenges and lessons learned from its implementation in developed countries and their application to developing countries: A systematic review. *PloS one*, 9(5), e96724. https://doi.org/10.1371/ journal.pone.0096724
- Team-Based Learning Collaborative. (n.d.). How big should the teams be? Retrieved from http:// www.teambasedlearning.org/answersto-faqs/#q3 2
- Tennyson, R. D. (2010). Historical reflection on learning theories and instructional design. Contemporary Educational *Technology*, *I*(1), 1-16.
- Valentine, M. A., Nembhard, I. M., & Edmondson, A. C. (2011, May). Measuring teamwork in health care settings: A review of survey instruments. Harvard Business School, report no. 11-116. Retrieved from http:// hbswk.hbs.edu/item/6727.html
- Villadsen, A., Allain, L., Bell, L., & Hingley-Jones, H. (2012). The use of role-play and drama in interprofessional education: An evaluation of a workshop with students of social work, midwifery, early years and medicine. Social Work Education, 31(1), 75–89. https://doi.org/10.1080/02615479. 2010.547186
- West, C., Graham, L., Palmer, R. T., Miller, M. F., Thayer, E. K., Stuber, M. L., ... Carney, P. A. (2016). Implementation of interprofessional education (IPE) in 16 U.S. medical schools: Common practices, barriers and facilitators. Journal of Interprofessional Education and Practice, 4, 41-49. https:// doi.org/10.1016/j.xjep.2016.05.002
- West, C., Veronin, M., Landry, K., Kurz, T.. Watzak, B., Quiram, B., & Graham, L. (2015). Tools to investigate how interprofessional education activities link to competencies, Medical Education Online, 20(1). https:// doi.org/10.3402/meo.v20.28627
- Woltenberg, L. & Taylor, S. (2018). Successes, challenges, and impact of a largecohort preclinical interprofessional curriculum: A four-year reflection. Currents in Pharmacy Teaching and

Appendix A CEM instructional design strategy applied to three IPE-initiative examples.

	Content		Evaluation		Method	
IPE- initiative example	IPEC sub- competency (IPEC, 2016)	Learning objective(s)	Kirkpatrick's level	Assessment tool	Theoretical framework	Approach
example Lochner et al. (2018)	(IPEC, 2016) Values/Ethics sub-competency #4: Respect the unique cultures, values, roles/ responsibilities, and expertise of other health professions.  Roles/ Responsibilities sub-competency #2: Recognize one's limitations in skills, knowledge, and abilities.  Team and Teamwork sub-competency #10: Use available evidence to inform effective teamwork and team-based prac-	"Reflect on their personal attitude to-wards critical incidents and how these are managed within an interprofessional team." (p. 4) "Recognize the perspectives and roles within an interprofessional team." (p. 4) "Decide which critical incidents need to be reported and justify the decision within an interprofessional	Level 1 (reaction to TBL)  Level 2 (attitudes toward IPE)  Level 3 (behavior in terms of individual performance)  Level 3 (behavior in terms of team performance)	Team-Based Learning Student Assessment Instrument (TBL -SAI) Interprofessional Questionnaire (UWE-IP-D) Individual Readiness Assurance Test (IRAT) Group Readiness Assurance Test (GRAT)	Social constructivism	InterProfession- al Education in Patient Safety (iPEPS) course tha uses TBL

Woltenberg & Taylor (2018)	Values/Ethics sub- competency #4: Respect the unique cultures, values, roles/ responsibilities, and expertise of other health professions and the impact these factors can have on health outcomes.  Values/Ethics sub- competency #4: Respect the unique cultures, values, roles/ responsibilities, and expertise of other health professions and the impact these factors can have on health outcomes.	"Students will be able to describe in general terms the programs of study of the various health professions programs participating in iCATS." (p. 664) "Students will be able to describe in general terms the scopes of practice of professionals in the various health professions programs participating in iCATS." (p. 664)	Level 1 (degree to which they agree that the iCATS experience provided a foundational understanding of IPE and collaboration in health care)  Level 2 (knowledge of other health professions' educational requirements and scope of practice)	Interprofessional Collaborative Competency At- tainment Scale (ICCAS)	Active learning Social learning	Interprofessional Collaboration And Team Skills (iCATS) curriculum that uses TBL
	Roles/ Responsibilities sub-competency #4: Explain the roles and responsibilities of other care providers and how the team works together to provide care, promote health, and prevent disease.  Roles/ Responsibilities sub-competency #6: Communicate with team members to clarify each mem-					
Christopher et al. (2019)	ber's responsibility in executing components of a treatment plan or public health intervention. Roles/ Responsibility subcompetency #4: Explain the roles and responsibilities of other care providers and how the team works together to provide care.	"Recognize the roles, responsibilities, and importance of various health care professionals in the patient-centered health care team." (p. 1) "Demonstrate teamwork, respect, integrity, and professionalism during interprofessional collaboration." (p. 1)	Level 2 (Attitudes about teamwork, collaboration, and IPE)	Readiness for Interprofessional Learning Scale (RIPLS) survey	Experiential learning	Interprofessional team role-play case
	Team and Teamwork sub- competency #4: Integrate the knowledge and experience of other professions— ap- propriate to the specific care situa- tion—to inform care decisions, while respecting patient and commu- nity values and priorities/ prefer- ences for care.					