# Online Interprofessional Health Sciences Education: From Theory to Practice

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*Online learning (e-learning) has a nascent but established history. Its application to interprofessional education (IPE), however, is relatively new. Over the past 2 decades the Internet has been used increasingly to mediate education. We have come past the point of "should we use the Internet for education" to "how should we use the Internet for education." Research has begun on the optimal development of online learning environments to support IPE. Developing online IPE should follow best practices in e-learning generally, though there are some special considerations for acknowledging the interprofessional context and clinical environments that online IPE is designed to support. The design, development, and deployment of effective online IPE must therefore pay special attention to the particular constraints of the health care worker educational matrix, both pre- and postlicensure. In this article we outline the design of online, interprofessional health sciences education. Our work has involved 4 educational and 4 clinical service institutions. We establish the context in which we situate our development activities that created learning modules designed to support IPE and its transfer into new interprofessional health care practices. We illustrate some best practices for the design of effective online IPE, and show how this design can create effective learning for IPE. Challenges exist regarding the full implementation of interprofessional clinical practice that are beginning to be met by coordinated efforts of multiple health care education silos.*

**Key Words:** *education, health sciences, interprofessional, online, clinical, context*

## Introduction

The Institute for Interprofessional Health Sciences Education (IIHSE/IEISS—the Institute) is a virtual learning institute established with Health Canada funding in 2005. The IIHSE was funded to design, develop, deploy, and evaluate online interprofessional education (IPE) modules to support

interprofessional health care practice. The IIHSE was founded to promote interprofessional education across institutions, faculties, practice sites, and communities of practice. We define IPE as per Health Canada's definition: "learning together to promote collaboration" in health services, including "socializing health care providers in working together, in shared problem solving and decision making, towards enhancing the benefit for patients, and other recipients of services; developing mutual understanding of, and respect for, the contributions of various disciplines; and instilling the requisite competencies for collaborative practice." Health Canada echoes the Centre for the Advancement of Interprofessional Education (CAIPE), which has defined IPE as "occasions when two or more professions learn from and about each other to improve collaboration and the quality of care."

The Institute uses distributing learning—e-learning combined with *in situ* learning—for the delivery of interprofessional education, including the use of Web-based teaching and learning tools for encouraging problem-based learning, reflective practice, and the creation of a community of practice around IPE and its transfer into collaborative practice within the health care system. This last point is perhaps the most important, for in order for education to be effective, it must result in the effective translation into practice of the

skills learned online.[1,2] This article outlines the design philosophy of the Institute and provides models for best practice development in online IPE.

## Online Interprofessional Education: Context

This section outlines the Institute's approach to designing online IPE. The Institute's focus on e-learning is designed to support the socialization of prelicensure students for a future of interprofessional collaborative patient-centered health care. That is, Health Canada, by way of its Interprofessional Education for Collaborative Patient-Centred Practice initiative,[a] is seeking to encourage interprofessional health care practice. The Institute, funded by Health Canada, was created to model and provide education delivery to support IPE at the pre- and postlicensure levels to support new interprofessional health care practices. The Institute chose an e-learning framework to overcome collaboration constraints such as time, scheduling, and geography. In this context, e-learning and collaborative models of educational delivery and development are time and cost effective and allow for sharing of resources and expertise.[3–8] Further, e-learning is an engaging activity that can facilitate interprofessional learning and understanding from groups that might not otherwise have an opportunity to learn together due to timetabling and scheduling conflicts. These are significant barriers to learning interprofessional knowledge and skills in both student and clinical environments. The use of asynchronous e-learning resources is an effective strategy to overcome these barriers. Various forms of online learning have been shown to be effective for health professions, from videoconferencing to asynchronous communication.[9–13]

Interprofessional education is designed to facilitate the transfer into practice of knowledge and skills learned within teams. The Institute's online learning materials were designed to enculturate learners into team-based or interprofessional learning and practice by offering practical models for interprofessional practice (behaviors) and case studies. The 2 aspects—learning and practice—should be considered in concert with each other. Students in the prelicensure stream learn about working in interprofessional health care teams, but they will also learn about learning within IPE contexts. This form of enculturation can acclimatize these learners for interprofessional contexts, provided learning activities are designed appropriately.[14–18] Learning activities build on learners' core knowledge while integrating key knowledge about working in interprofessional teams, the implications of this, and what it means for interprofessional practice. Such enculturation will better prepare this generation of learners to engage in collaborative practice and other activities mediated by technologies. This will

encourage the construction of communities of practice across disciplines and will have positive effects both in the immediate term of teaching learners about interprofessional care and practice, as well as in teaching them about collaborating within virtual—and real—communities of practice more generally in future workplaces.[19,20]

Although it is important to acknowledge that current health care workers may have less aptitude for technology use generally (and so, by extension, learning over the Internet), it is reasonable to assume that health care students (particularly those under 25) will more readily use technology.[21] E-learning should thus be a staple of prelicensure education. Care should be taken, however, to ensure that those professionals already in the workplace have access to adequate support in learning to learn—about interprofessional practice at the practice site, but also through the Internet. Most, if not all, working professionals will use the Internet at least for e-mail, so there are precedent skills on which to build. Interprofessional communication in practice is enabled by technology generally (cf e-mail); socializing early to the use of technology as a communication medium is therefore essential to future ability to use online media as a means of professional communication, collaboration, and learning.[22] Nonetheless, professionals in the field require some basic supports as they learn to learn online, including clear instructions, the ability to practice skills, and good facilitator support. These kinds of supports are built into the curriculum and are designed to help all learners make the most of the online learning experience.

## From Context to Content

The Institute's online IPE is characterized by knowledge building, constructivist, problem-based, and transformative learning where content is part of online collaboration activities, reinforcing the offline and online connections between learning and practice within teams.[18] Participatory and collaborative models of instructional design were used to create IPE material. These are effective means of engaging a dispersed team in collaborative program design and learning.[10,23]

The Institute uses problem-based learning (PBL) to transfer knowledge from the online to the offline world. An orientation to the goals of IPE is useful. D'Eon[24] reports the following key characteristics of IPE:

- The need to **challenge students** with learning activities and tasks that increase in complexity as they go through the learning materials.
- IPE should use "the five elements of best-practice **cooperative learning**: positive interdependence, face-to-face promotive interaction, individual accountability, interpersonal and small-group skills, and group processing"
- **Experiential learning** frameworks should be used to challenge students with real life cases, and to test their knowledge and skills and ability to work in IP teams.

*What this Means for Online IPE Curricula*

*Challenging students.* Institute learning activities should be designed to introduce learners to the competencies/outcomes and objectives in such a way as to build on existing knowledge, create new knowledge, and facilitate movement through 3 learning domains:

- Cognitive/knowledge: thinking
- Psychomotor/skills: doing
- Affective/attitude: feeling

D'Eon[24] adds to this "relating in groups" (p. 50), a key facet of IPE. This aspect of social learning is key to theories of situated learning that see social context as important in the construction of identity, as learners grow from apprentices to masters.[25–29] Students need to move through the acquisition of knowledge domains (health care role and interprofessionalism), through the motivation to work in interprofessional contexts, to the acquisition and application of new skills, both in terms of learning and working. To this we add reflective practice advocated by theories of transformative learning[30,31] to scaffold learners through constructivist knowledge building within communities of practice and learning within workplaces.[8,14,15] Learning content is therefore synchronized with course-level outcomes in a staged fashion so as to facilitate this type of learning pathway. The goal is to enable our students to be able to transfer what is learned online into interprofessional clinical practice.

Simply put, our learning elements, problems, and case studies establish core content, encourage critical reflective practice, and build onto this more complexities so as to challenge learners to integrate new knowledge within clinical care plans and interprofessional practice. One way we have done this is to show students a video clip without sound that students must then describe. The same video with sound is then presented, and students are asked to compare their initial reactions to the sound version. The video is designed to elicit a stereotypical response from students, who are then confronted with this and made to see that their assumptions of health care roles is perhaps wrong. Another way this is done is to have students write comments on the online discussion board, and then compare their responses to others' responses, looking for similarities and differences and common professional assumptions. These kinds of activities encourage learners to formulate new knowledge based on awareness of prior assumptions and how these "meaning schemes"—and the learners themselves—fit into the world around them.[30–34]

*Cooperative learning.* The 5 elements of cooperative learning undergird our IPE curriculum development. *Positive interdependence* refers to working in teams to build collective knowledge. Reinforcing this within online IPE con-

texts and discussions will enable us to teach our students about working with others in the pursuit of clinical problem solving. *Face-to-face promotive interaction* is "activity such as discussion, debate and joint decision-making . . . where members help each other to succeed."[24] We utilize asynchronous discussion boards to meet the same objectives. Although face-to-face interaction is impossible to mimic online, asynchronous discussion does promote the same kind of constructive dialogue. In this case, the instructor takes an important role in helping students to maintain focus over time on a particular topic, and to ask questions of the students in order to elicit responses that reinforce learning objectives. *Individual accountability* means that each student is accountable for being a full member of the interprofessional team. Each student is tested on core knowledge/prior learning as a fundamental component of participating in the IPE curriculum. We also use reflective practice, peer assessment and peer review, as well as mentorships, to facilitate individual accountability. These encourage learning, knowledge transfer, and growth of professionalism within social context.[12,23] *Interpersonal and small-group skills* are the essence of interprofessional clinical practice. Our practice sites provide case studies for the modeling of effective team skills; students can work with practice-site colleagues to test their ideas. *Group processing* is where we ask our learners to reflect on their practice, learning, and knowledge transfer. This is done both in online groups and individually. In the latter, learning portfolios of self-assessments are done by students as they track their own developmental trajectory in a given course.

We construct curricula by creating learning materials and activities that present problems (of increasing complexity). Learning teams (groups of students, or a student paired with a practice-site mentor) use online discussion forums to tackle the problems. Interprofessional contexts are integrated within these problems and case studies. Self-assessment quizzes and other evaluation mechanisms are used to test knowledge gains. Collective evaluations, used to measure learning and transfer, are conducted by the instructor or facilitator and by peer-group assessment. Finally, learning groups collectively critique their experiences through reflective practice.

*Experiential learning.* Problem-based or case-based learning is designed to introduce to the student clinical cases that encourage active learning, critical thinking, and *in situ* problem solving. By exposing students to a variety of problems and case studies, they learn to apply their knowledge and to transfer learning into multiple contexts. Using e-learning in this fashion assists in knowledge transfer and change in practice.[9] Curran and Fleet recommend an adaptation of Kirkpatrick's model for summative evaluation that evaluates learning based on reaction, learning, behavior, and results,[35] with results being patient/health outcomes.[9]

## Developing Learning Activities

Oandasan and Reeves,[36] using the framework of D'Amour and Oandasan,[37] provide an IPE pedagogical model that encourages learners to understand their role and others' roles (knowledge domain), thereby enhancing skills and behaviors in both communication and reflection, and fostering attitudes of "mutual respect open[ness] to trust, and willing[ness] to collaborate." Encouraging learners to understand their own role, and that of others, can be based upon critical reflection of their own prior knowledge, attitudes, and skills, and the emergence into interprofessionalism. The Oandasan and Reeves tripartite structure provides a useful framework for the design of the learning activities, as illustrated below.

### Knowledge: Roles

In concert with this information delivery, the learning activities fashion interaction among the learners to engage with each other related to facilitating understanding among roles and responsibilities. This interaction is focused on the case studies/PBL exercises, and may take the form of learner interaction with learning materials (learner reads materials or views online videos), learner–learner interaction using communication tools (through asynchronous online or face-to-face discussion), or learner–mentor discussion (through online or face-to-face discussion).

### Skills/Behaviors: Communication and Reflection

Fostering effective communication skills is done in concert with the learning activity design as outlined above. Communication technologies within the learning management system (LMS—any online system for delivering e-learning, such as WebCT or Blackboard) used enable distributed teams to communicate, and have a record of their case-based PBL communication activities. Reflective practice can be implemented within the curricula by having learners keep a journal and engage in reflective practice exercises and learning materials. This includes the use of interprofessional care plans, which are used as a way to teach learners about the different health worker perspectives. These care plans are created by the learners with specific instructions to include other health profession points of view. Learners can share their reflections within their learning communities through online discussions, Web pages (personal and project/team), and by using mentorship models with those already working in the practice sites.

### Attitudes: Respect, Trust, Collaboration

This aspect of the IPE structure is for higher-cognition/domain activities. Communication and reflective practice activities are worked into the learning activities in order to broker learner engagement within communities, facilitating the development of communities of practice within interprofessional teams. Learners can compare their health worker role-specific experience with those from other professions as well as their own. Our thinking is that this will lead to better collaboration based on a shared understanding of what each profession brings to the patient experience.

## Testing the IIHSE Curricula

The Institute created 8 prelicensure and 4 postlicensure modules focusing on core aspects of interprofessional health care practice. These covered the following topics:

Prelicensure:
- Aboriginal health
- Communications (2 modules)
    - Part 1: Establishing and Understanding Relationships
    - Part 2: Making the Most of Groups and Teams
- Community practice: health promotion
- Ethics
- Interprofessional stroke care: an interprofessional approach
- Palliative care/total pain
- Interprofessional Healthcare in Rural Areas: The Patient and the Community

Postlicensure:
- Conceptualizing interprofessional collaboration
- Helping groups reconceptualize
- Team processes and norms of practice
- How to assess a team's effectiveness

In addition, 2 introductory modules were developed: Orientation to e-Learning and Orientation to Problem-Based Learning. A facilitator guide was also developed to support those leading the learning. Online learning content used a variety of media formats: narrative text and readings, video, interactive learning objects, quizzes, self-assessment tools such as learning portfolios, interprofessional care plan development and discussion activities designed to engage learners in self-reflection, problem-based learning, and reflective practice.

Learning materials were developed iteratively by a collaborative team of content experts, professional writers, instructional designers, and media developers and programmers. Once the modules were developed, an initial pilot run of several modules was conducted, wherein student volunteers participated in the modules and provided feedback on content, media, learning activities and structure. This feedback was used to revise modules as relevant and required. Finally, 10 modules were deployed and evaluated over a 14-month period. Participants included 156 students and 27 clinicians. Although a full description of the evaluation reports is currently under preparation, we present here a summary of some key findings as they relate to the creation of online IPE.

Student feedback on the modules was solicited through the Student Module Feedback Form (SMFF). Interviews, focus groups, and analysis of online discussions also augmented our evaluative work. Generally, students were happy with the module structure (how it was displayed) and the content (what was said). Collaborative learning was highly rated and, coupled with the content, enhanced students' perception in improving their knowledge and collaboration skills. Areas of improvement were noted, including deadlines for modules that were not explicit about these, and support for online learning generally. A qualitative content analysis of the discussion boards was used to understand student concerns with *content* and *process*. Content themes included communication strategies to support IPE and IP practice, sharing professional roles, collaborative problem solving, and awareness of teamwork and collaboration. Process themes included providing information (ie, how students learn to provide clinical information to other health care workers), positive attitudes toward IPE, relating or agreeing in health care teams, and asking another's perspective.

Our findings indicate that students were keen to learn with, about, and from others, provided this included a grounding in their own specific professional role. This is supported by others (see, for example, Posel et al[19]), as uniprofessional socialization is an important foundation to being able to learn with others and, perhaps more importantly, learn how interprofessional clinical practice can best be enabled. Institute students at times expressed frustration with the problem-based learning approach, as they at times wanted to know the "right" answer, rather than what avenues may be available to uncovering this. This suggests that the role of the facilitator is important in online IPE that takes a problem-based learning approach. However, facilitators should also encourage more advanced problem solving on the part of the students as they acquire new skills and the confidence to exercise interprofessional judgment. E-learning is effective for IPE in our experience with it, but the importance placed on the role of the facilitator underscores the necessity to support students learning new skills commensurate with their own health care practice and translating skills learned online into practice.[10] We can call this *extensible online learning*, where the goals of skills transference are made explicit in relation to online learning, and these skills are in fact transferred into practice.

The postlicensure pilot participants were from 5 clinical practice facilities from across Ontario. Similar methods as for the students were used for soliciting feedback from the practice site groups, including a Clinician Module Feedback Form. Again, content and presentation of content were highly rated, whereas support for online learning was not easily accessible. We found that, although some gains were made in team members' ability to work effectively and interprofessionally, results for this group were modest. We feel this is due to the lack of time to develop and practice new interprofessional team skills.

## Conclusion: Creating a Culture of Interprofessional Practice

In our experience online collaborative group learning can be an effective way for students to learn about interprofessional practice, a finding others have supported.[38] In particular, the use of interprofessional care plans in e-learning contexts can be a blueprint for future interprofessional care.[19] For those health care workers seeking to (re)learn about interprofessional practice, asynchronous communication in online learning aids in overcoming the twin challenges of geography and time, thereby enabling practicing health workers to learn together.[39] Dedicated time and a space for learning are essential for effective e-learning in the work environment.[1,40] Failure to provide this will lead to frustration and a less-than-ideal learning experience. It is also important to integrate online learning with existing professional development activities and to provide an opportunity to practice the skills learned online; this will be more successful in those organizations with a willingness to innovate.[41] Key to the successful translation of skills learned online is also the grounding of new practice within the local systems in which work practices are articulated.[42]

The development of e-learning is costly in relation to providing face-to-face instruction. All materials must be preassembled, media created (which itself involves a long developmental trajectory), and a system put in place to house learning materials and track learner progress. Finding experienced facilitators for e-learning may be a challenge. Our recommendation is to find content experts and teach them how to teach online. Ongoing support for the facilitators and the learners is essential. Socializing professionals in practice to learning in this way may also be a challenge. Because the courses we constructed were ancillary to students' regular programs, we experienced some difficulty in maintaining student involvement in the face of competing, mandatory educational requirements. As noted above, e-learning can help overcome conflicting schedules because of its asynchronous nature. However, in our project the varied clinical schedules of our student participants created problems in trying to organize student team clinical placements following the online courses. It was also difficult to recruit physicians to participate in the practice stream.

A willingness to innovate may be a key driver of future interprofessional practice, or rather its effectiveness. Although evidence of the relative value and effectiveness of interprofessional clinical care is still emerging, most health care practitioners agree that this is something that should be done. As more evidence emerges as to the validity of this form of care, we will see an evolution similar to that experienced by e-learning, as mentioned at the start of this article. That is, we will move from *should* we practice interprofessional care to *how best should* we practice interprofessional care. Our experience, and the growing

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**Lessons for Practice**

- Online interprofessional education can be an effective way to socialize prelicensure students into effective interprofessional care.

- Online interprofessional education can be an effective way to engage postlicensure health care workers in learning how to enact effective interprofessional care.

- Online interprofessional education must be designed with interprofessional teams, accounting for content expertise in core subject matters, media design and development, and interprofessionalism.

- Translating skills learned online into effective practice requires good pedagogical design as well as champions inside the work practice area.

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body of evidence emerging in the literature, show that online learning is effective for teaching both pre- and postlicensure groups about the value of interprofessionalism, and more importantly, its transfer into effective health care practice.

### References

1. Atack L, Luke R, Sanderson D. Development of an online, team-based programme in Telecare. *J Telemed Telecare*. 2004;10(6):355–360.

2. Atack L, Luke R. Impact of an online course on infection control and prevention competencies. *J Adv Nurs*. 2008;63(2):175–180.

3. Arias AA, Bellman B. Networked collaborative research and teaching. In: Boschmann E, ed. *The Electronic Classroom: A Handbook for Education in the Electronic Environment*. Medford, NJ: Learned Information; 1995:180–185.

4. Bereiter C, ed. Learning technology innovation in Canada [Special issue]. *J Distance Educ*. 2003;17(3).

5. Chen LLJ, Gaines B. Modelling and supporting virtual cooperative interaction through the World Wide Web. In: Sudweeks F, McLaughlin M, Rafaeli S, eds. *Network and netplay: Virtual groups on the Internet*. Menlo Park, CA: AAAI Press/MIT Press; 1998:221–242.

6. Harasim L, Hiltz SR, Teles L, Turoff M. *Learning Networks: A Field Guide to Teaching and Learning Online*. Cambridge, MA: MIT Press; 1995.

7. Harasim L, Weinstein J. *Learning Online: Voices From the Ether and Intellectual Amplification*. Toronto, Canada: Educational Evaluation Centre, Ontario Institute for Studies in Education; 1989.

8. Scardamalia M, Bereiter C. Computer support for knowledge-building communities. In: Koschmann T, ed. *CSCL: Theory and Practice of an Emerging Paradigm*. Mahwah, NJ: Erlbaum; 1996.

9. Curran V, Fleet L. A review of evaluation outcomes of Web-based continuing medical education. *Med Educ*. 2005;39:561–567.

10. Juntunen A, Heikkinen E. Lessons from interprofessional e-learning: Piloting a care of the elderly module. *J Interprof Care*. 2004;18(3):269–278.

11. Sargeant A, Mann J, Fleming K, Premi MJ. Videoconferencing for practice-based small-group continuing medical education: Feasibility, acceptability, effectiveness, and cost. *J Contin Educ Health Prof*. 2003;23(1):38–47.

12. Miller P, Huijbregs M, French E, Taylor D, Reinikka K, Berezny L. et al. Videoconferencing a stroke assessment training workshop: Effectiveness, acceptability, and cost. *J Contin Educ Health Prof*. 2008;28(4):256–269.

13. Sears K, Cohen J, Drope J. Comprehensive evaluation of an online tobacco control continuing education course in Canada. *J Contin Educ Health Prof*. 2008;28(4):235–240.

14. Billett S. What's in a setting? Learning in the workplace. *Aust J Adult Community Educ*. 1993;33(1):4–14.

15. Billett S. Situated learning—A workplace experience. *Aust J Adult Community Educ*. 1994;34(2):112–130.

16. Billett, S. Searching for authenticity. *Vocat Aspect Educ*. 1994;46(2):3–16.

17. Hofstader R, Munger P. Education in the workplace: An integral part of the development of professionals. In: Cervero R, Azzaretto J, eds. *Visions for the Future of Continuing Professional Education*. Athens, GA: Georgia Center for Continuing Education, University of Georgia; 1990.

18. Vroman K, Kovavich J. Computer-mediated interdisciplinary teams: Theory and reality. *J Interprof Care*. 2002;16(2):159–170.

19. Posel N, Fleiszer D, Wiseman J, Birlean C, Margison J, Faremo S, et al. Using electronic cases to teach healthcare professionals and students about interprofessionalism. *J Interprof Care*. 2008;22(1):111–114.

20. Richardson B, Cooper N. Developing a virtual interdisciplinary research community in higher education. *J Interprof Care*. 2003;17(2):173–182.

21. Caison AL, Bulman D, Pai S, Neville D. Exploring the technology readiness of nursing and medical students at a Canadian University. *J Interprof Care*. 2008;22(3):283–294.

22. Sensmeier J. Survey says: Care communication enhanced by IT. *Nurs Manag IT Solut*. 2006;37(10).

23. Luke R, Mallory D, Atack L. Constructing context-based e-learning to support telehomecare communities of practice. *IEEE Comput Soc Learn Technol Newsl*. 2004;6(1):32–36. http://lttf.ieee.org/learn_tech/issues/january2004/learn_tech_january2004.pdf. Accessed February 18, 2004.

24. D'Eon M. A blueprint for interprofessional learning. *J Interprof Care*. 2005;19(suppl 1):49–59.

25. Lave J, Wenger E. *Situated Learning: Legitimate Peripheral Participation*. Cambridge, United Kingdom: Cambridge University Press; 1991.

26. Wenger E. *Communities of Practice: Learning, Meaning and Identity*. Cambridge, United Kingdom: Cambridge University Press; 1998.

27. Swanwick T. Informal learning in postgraduate medical education: From cognitivism to "culturism." *Med Educ*. 2005;39:859–865.

28. Wood D. Interprofessional education: Still more questions than answers? *Med Educ*. 2001;35:816–817.

29. Dolmans D, Wolfhagen IHAP, van der Vleuten CPM, Wijnen WHFW. Solving problems with group work in problem-based learning: Hold on to the philosophy. *Med Educ*. 2001;35:884–889.

30. Imel S. Transformative learning in adulthood. *ERIC Digest, 200*. http://www.ericdigests.org/1999-2/adulthood.htm. Accessed September 14, 2005.

31. Mezirow J. Transformation theory of adult learning. In: Welton M, ed. *In Defense of the Lifeworld*. New York, NY: SUNY Press;1995:39–70.

32. Cranton P. *Understanding and promoting transformative learning: A guide for educators of adults*. San Francisco, CA: Jossey-Bass; 1994.

33. Mezirow J. *Transformative Dimensions of Adult Learning*. San Francisco, CA: Jossey-Bass; 1991.

34. Mezirow J. Transformative learning: Theory to practice. *New Dir Adult Contin Educ*. 1997;74:5–12.

35. Kirkpatrick D. *Evaluating Training Programs*. San Francisco, CA: Berret-Koehler; 1994.

36. Oandasan I, Reeves S. Key Elements of Interprofessional Education. Part 2: Factors, Processes and Outcomes. *J Interprof Care*. 2005; 19(suppl 1), 39–45.

37. D'Amour D, Oandasan I. Interprofessional education for patient-centred practice: An evolving framework. In: Oandasan I, D'Amour D, Zwarenstein M, Barker K, Purden M, Beaulieu MD et al, eds. *Interdisciplinary Education for Collaborative, Patient-Centred Practice: Research & Findings Report*. Ottawa, Canada: Health Canada; 2004.

38. Miers ME, Clarke BA, Pollard KC, Rickaby CE, Thomas J, Turtle A. Online interprofessional learning: The student experience. *J Interprof Care*. 2007;21(5):529–542.

39. Walsh K. Interprofessional education online: The BMJ learning experience. *J Interprof Care*. 2007;21(6):691–693.

40. Atack L, McLean D, LeBlanc L, Luke R. Preparing ED nurses to use the Canadian triage and acuity scale with Web-based learning. *J Emerg Nurs*. 2004;30(3):273–274.

41. Robertson M, Umble K, Cervero R. Impact studies in continuing education for health professions: Update. *J Contin Educ Health Prof*. 2003;23(3):146–156.

42. Suchman L. (2002). *Located accountabilities in technology production*. Department of Sociology, Lancaster University. http://www.comp.lancs.ac.uk/sociology/papers/suchman-located-accountabilities.pdf. Accessed August 22, 2002.