INSTRUCTIONAL DESIGN AND ASSESSMENT

Elective Self-Care Course Emphasizing Critical Reasoning Principles

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Objectives. To create, implement, and assess a self-directed online course based on 3 critical reasoning principles to develop pharmacy students' skills in literature appraisal, content, metacognition, and assessment.

Design. Students completed 3 assignments for the course: compile a literature appraisal on a healthcare topic; plan learning objectives and meta-cognitive skills for a learning module; and create a case-based online lesson with multi-structured feedback.

Assessment. An online exit survey evaluated students' perceptions regarding development of ACE (agency, collaboration, expertise) principles and preparation for competency. Students reported acquisition of ACE principles and noted improvements in their learning approaches, sense of responsibility for individual and community learning, skills, and confidence.

Conclusions. An online elective course in self-care addressed practice standards for patient safety, maintenance of competency, and interprofessional education by emphasizing critical reasoning skills.

Keywords: self-care, critical reasoning, e-learning

INTRODUCTION

Graduating pharmacy students must be able to synthesize and incorporate content and skills developed across themes and throughout the doctor of pharmacy (PharmD) curriculum to address patient needs in practice. They must meet national competency standards for patient safety, professional development, and ability to contribute to communities of practice. While integration of all of the material learned is part of several therapeutic laboratory courses in the final year of the PharmD curriculum, the design of these courses is teacher rather than student directed. They do not address the ability of students to identify areas of deficiency and assume responsibility for maintaining their competence after graduation.

An important component in designing and assessing learning experiences, as advocated by modern cognitive psychology, is the provision of deep, meaningful learning to ensure the greater permanence, transference, and utility of knowledge.¹ This deep learning is facilitated by provision of new knowledge in an authentic context, constructive integration with prior knowledge, provision of collaborative elements, and some degree of self-direction.²

This paper addresses how the course design prepares students for practice competency standards through incorporation of 3 components essential in critical reasoning: agency, collaboration, and expertise (ACE). Learning environments create opportunities to enhance the processes of agency, collaboration, and expertise, ranging from works in philosophy, to the history of science, to other professions such as medicine.³⁻⁵

Agency encompasses students' self-direction and empowerment in constructing their own learning goals, determining content, selecting assessment measures for self or peers, and using reflection and recalibration to enable self-regulation.

Agency refers to the ability to be self-regulated as a learner and professional. Effective self-regulation requires self-assessment and remediation of competency gaps. Agency is accomplished when the learner demonstrates self-direction and self-monitoring of relevant learning goals, learning formats, and reflective self-assessment. This is critical to the ability of health care professionals to control their own knowledge advancement. Learners direct processes normally controlled by teachers: setting goals, planning, motivation, and evaluation of understanding.⁶ Learners must also negotiate the assimilation of their ideas with others to advance understanding, revising cyclically. Epistemic agency enables acquisition of knowledge and skill in an inexperienced subject area.⁷ Course designs should enable high levels of epistemic agency practicing metacognitive processes.

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Collaboration is negotiating peer synthesis of individual ideas, and being collectively responsible for community knowledge. It is facilitated through agency, which includes taking responsibility for community knowledge through collaborative work, socially as well as cognitively.⁷ In designs which accent collaboration, students offer support, constructive criticism, and sustained idea improvement, while recognizing current best practices and available resources.⁸ Collaboration creates deeper understanding for both individuals and groups and should be encouraged in a self-directed course. This includes role-modeling using prior assignments that are illustrative of appropriate style and formats. This transparency, in addition to selection of unique topics for each cohort, deters academic dishonesty.

Expertise is developed through observation of samples that enable heuristic script acquisition. Models should provide multiple iterative or progressive contextual active-learning experiences that demonstrate practice context validity. They should enhance evaluation skills that demonstrate clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, exception recognition, depth and breadth. Models also increase confidence in conceptualization, judgments, and communication; and increase skill in translation of knowledge to others at the appropriate audience level. Expertise is also supported through effective learning environments which offer collective opportunities to exhibit high-order reasoning such as progressive problem-solving skills, a deep understanding of knowledge within a domain, and a commitment to advancing knowledge for society.^{9,10,11} Effective expert analytic thinking is exhibited in organizations with high levels of self-efficacy, control, and collaboration. More in-depth information regarding effective activities for reflection and skill integration are found in psychology and education literature.¹²⁻¹⁵

Courses that encourage students to become epistemic agents with collaborative goals also help them to develop expertise. The author theorized that a course in which students directed their learning and engaged in designing lessons about clinical problems to advance community knowledge would prepare students to be self-regulating health professionals.

The course was designed to be student-centered¹⁶ as the degree to which teachers relinquish responsibility and authority to students is central to students developing genuine agency.⁸ Teachers' reluctance to entrust students with a high level of agency results in mixed approaches to teaching such as "cooperative learning," "self-regulated learning," and "guided discovery." When students are free to explore in depth and reflect on their state of understanding, they become the agents of their own intellectual development.

Perceived self-efficacy, where medical students felt they could control objectives and results, was a strong

motivator for learning, and increased their ability to cope with poor results.¹⁷ In allowing students the ability to develop relevant knowledge, they may engage more, and increase their personal and community levels of knowledge and control over learning.

DESIGN

A self-directed online course was created to facilitate progress in the 3 contributing components of ACE. Students critically assessed the literature; planned strategies for delivering content goals and building meta-cognitive skills; and created an interactive, case-based integrated e-lesson, with multiple-choice options and feedback regarding knowledge and assessment skills.

Teaching and assessment approaches for the course fostered ACE critical reasoning determinants. At the completion of the course, students should feel better prepared to meet the targeted practice competencies. Within each ACE domain, levels of achievement of competency standards are best addressed through use of recognized taxonomies. Learning objectives, aligned to distinguish appropriate learning levels as defined through the SOLO taxonomy of Biggs and Collis,¹⁸ as well as performance competencies as described through Miller's taxonomy for professionals,¹⁹ were linked to teaching methodologies and assessment measures.

Courses usually only consider educational standards (in Canada these are set by the Association of Faculties of Pharmacy of Canada). This course also addressed professional standards for practice based on licensing requirements set nationally and interpreted provincially. Key competencies that assess readiness to practice from the Canadian National Association of Pharmacy Regulatory Authorities (NAPRA)²⁰ and were pertinent to this course were selected to help examine course outcomes: patient safety (first and fifth competencies); and self-regulation, maintenance of competency, and fostering inter-/intra-professional collaboration (fourth competency).

Competency 1: Provide patient care. The elements include ability to assess the patient's needs; develop a therapeutic plan with implementation, monitoring, documentation, and patient education, ensuring patient safety. Decisions must be 'evidence-informed': "the integration of experience, judgment and expertise with the . . . judicious use of current best evidence in making decisions about the care of patients."

Competency 4: Maintain professional development and contribute to the professional development of others. The elements include the ability to plan professional development strategies and contribute to the professional development of colleagues. Professional development

is “the process whereby health care providers acquire and assimilate an increasing breadth and depth of professional knowledge and skills and apply it to their practice, with the goal of improving patient care and practice outcomes.”

Competency 5: Contribute to public health and the effectiveness of the health care system. Selected elements include the ability to establish collaborative relationships with health care providers; contribute to the education of students and health professionals and contribute to the application of new knowledge and skills to pharmacy practice and health care.

The University of Toronto’s Faculty of Pharmacy has a baccalaureate pharmacy curriculum with multiple concurrent courses. The final year is comprised of a workload-intensive autumn semester followed by 4 months of hospital and community practice experiences, which precede a national licensing examination.

In 2003, the curriculum committee approved a fourth-year self-care elective, offered in the autumn semester prior to experiential courses and following 2 required courses in self-care during the second and third years. The self-study online therapeutics course was intended to develop students’ skills in active, problem-based learning, critical literature appraisal, health professional teaching, and life-long self-directed learning. Students explored the pharmacist’s role in self-medication in depth for 1 self-limiting or mild condition. Students were to integrate and apply the knowledge and skills acquired in the previous 2 self-care courses as well as from other subjects including critical appraisal, therapeutics, and pathophysiology. Enrollment was limited to 25 students. The author was the sole instructor and assessor.

An online case format was used because it was most appropriate for a course that required abstract conceptualization: logical thinking and rational evaluation. Students were charged with creating online lessons intended for their own learning and that of other pharmacy students. The 3 course assignments encouraged “higher-order skills” including independent learning, planning, and reasoning; research skills; and teaching skills. As context is critical to educating health care practitioners, lessons had to center around valid patient case examples. The assessment tools later used by the instructor to evaluate each assignment were available online for the students’ formative self- and summative peer assessment. There was no scheduled class time. Instead, the instructor held one-on-one advisory and review sessions at the students’ request to provide them with feedback on their progress. Optional group tutorials were held for all students to clarify issues or discuss helpful hints based on previous iterative efforts.

In keeping with ACE principles, 3 course assignments were developed to provide a format for students to develop critical reasoning skills using a variety of tasks to reinforce, improve, and transfer skills, ultimately increasing students’ readiness for practice competencies.

The format of the final assignment, creation of an online interactive self-care case for student peers, served several purposes. It allowed students to build upon and integrate knowledge and skills learned in courses from previous years (constructivism); provided a context in self-care where the pharmacist must be truly self-regulatory and accountable for patient outcomes and patient safety; provided topics of interest to a broad interprofessional audience of health sciences practitioners (eg, nurses, medical doctors, dieticians) who may need to use this information and yet not have specific training.

Assignment 1: Literature review, critical appraisal, and annotated bibliography (20%). Students conducted an extensive literature review of relevant print and online resources that were used throughout the course as appropriate. From this, they identified the key reference articles they would use for their interactive case and completed an annotated bibliography of all their resources, including a brief critical appraisal of each, based upon a 7-tiered evidence pyramid learned in a previous course.

Assignment 2: Completion of one sample interactive case, learning objectives, flowchart, abstract, test file (20%). For the second assignment, students reviewed at least 1 previously published case to use as a model. The students then established competencies for the learner based on Miller’s taxonomy, and defined learning objectives for the lesson according to the SOLO taxonomy, using appropriate verbs to convey the relevant level of Bloom’s taxonomy. Students then created a narrative plot for their lesson, with details about the setting and patient characteristics described and summarized in an abstract. They planned their lesson visually using a flowchart or schema that showed the order in which questions would be presented to the learner. They linked each question to the character involved, content covered, corresponding learning objective, and SOLO taxonomy level of learning, (gradually building levels from analysis to synthesis, to evaluation). Students created a test file, inputting the abstract, learning objectives, a test question with answer options and feedback, and a test image, to work out challenges in html coding, visualization, ensure connectivity, and cite appropriate references.

The data submission was accomplished through an instructor-created Access database, using FrontPage extensions, installed on Microsoft Internet Information Service. Four active server page files were written as templates to dynamically generate html pages. A submission page was

developed with instructions and a sidebar for database manipulation, allowing students to add, delete, edit, or copy a question; print or run a case; and upload and download images.

Students developed a final post-lesson question that tested the learner's overall understanding of key concepts as they applied to another patient case. Students were given guidelines concerning the taxonomies and behavioural terms to use in setting objectives, and a chart to map assignment elements.

Assignment 3: Completion of an interactive, case-based integrated online lesson (60%). The major component of the course was development of 1 teaching lesson for health care professions students or health care practitioners in an online interactive multimedia format. Each lesson provided 1 or more clinical case histories or medically important situations with corresponding multiple-choice questions. Learner feedback included summaries about degree of accuracy, clarifying explanations for incorrect or partially incorrect responses, content strategy for the question structure, and meta-cognitive feedback in terms of what learning skills were required (analysis, synthesis, evaluation, etc) linked to the SOLO taxonomy, reference citations, and online links for further discovery. While students were not expected to have advanced Web design and programming skills, the final teaching module had to be functional online. Data for the developing case, which was stored in the Access database, was always accessible to the instructor. For the end user, cumulative scoring was generated automatically on each page.

The students determined the due dates for the 3 assignments as well as the weighting of each (20%, 20%, and 60% of course grade, respectively). (Samples of each assignment, together with the assessment rubrics, used for self, peer, and faculty measurements are available from the author.) There were no course examinations.

EVALUATION AND ASSESSMENT

Miller's taxonomy of competency performance was used to assess each course component for the student.¹⁹ This taxonomy is similar to that of Bloom but focuses on performance outcomes commonly represented as a 6-level pyramid: heard about, knows about, knows, knows how, shows how, and does. The SOLO Taxonomy analysis instrument of Biggs and Collis rates 5 learning levels for critical reasoning: 1 = pre-structural; 2 = uni-structural; 3 = multi-structural; 4 = relational; 5 = extended abstract,¹⁸ and was used in 2 different contexts: by the teacher in assessing student reasoning in the 3 components of the course, and by students in designing the learning objectives and course content for their online lesson. The learning objectives for the course and sample topics

are found in Table 1. The final product was reviewed for multiple components, including content, teaching strengths, online functionality and creativity.

Course Assignments

For each of the 3 assignments, the student's overall performance was assessed based on a global rating scale of 5 levels based on the SOLO taxonomy levels of Biggs and Collis: inadequate, marginal, adequate, good, and superior (demonstration of evaluation and judgment). In addition, specific sections of each assignment were evaluated for relevant content and skills domains.

For assignment 1 (literature review), there were 2 key assessment components: management of the information, including focus, coherence, organization and development; and communication of the information (technical proficiency). The instructor provided additional written comments on the assessment form regarding the student's demonstration of critical reasoning through clarity, precision, logic, relevance, significance, depth, fairness, and accuracy.

For assignment 2 (sample interactive case), there were 3 key assessment components (each divided into 5 levels): quality of the information, including content planning (focus, coherence, organization and development; teaching planning; and communication of the information (technical proficiency). Instructor comments surrounded demonstration of critical reasoning through lesson planning in terms of purpose, question, information, inferences, concepts, assumptions, point of view, implications and interpretations.

For assignment 3 (interactive case-based lesson), there were 3 key assessment components (each divided into 5 levels). Quality of the presentation rated communication of the information (technical proficiency); conformance to format, relevance and appropriateness of questions, use of illustrations, conformations to the conventions of language, links to other Web pages, appropriate references. Quality of the information considered content planning (focus, coherence, organization, and development), understanding the issues, and clinical application. The third assessment component was content integration. Additional comments could be noted.

Both cohorts (2010 and 2011) achieved summative course outcomes that exceeded expectations, as determined by aggregate means of A+ for overall combined performance. Boards of examination reports for each year list individual course means for concurrent validity, and generally, they are in the B to B+ range for fourth-year students. This course, with a high level of performance required for completion (synthesis and evaluation), had the highest mean grades compared to other senior-year required and elective courses.

Table 1. Learning Objectives for an Online Elective Course in Self-Care

Upon successful completion of this course, each student will:			
1. Develop an in-depth understanding of one self-medication topic			
2. Develop skills in active problem-based learning: evaluation and integration of knowledge to a problem			
3. Develop skills for self-directed life-long learning			
4. Develop written communication skills			
5. Develop teaching skills for health care professionals			
6. Contribute to a case-based online resource for self-medication topics			
7. Develop skills in critical literature appraisal: written and online			
8. Access and become familiarized with asynchronous educational opportunities			
9. Enhance proficiency in web-based technology			
10. Acquire the knowledge and skills required to deliver pharmaceutical care within a self-medication context			
for one in-depth topic as follows:			
a. Be able to identify, prevent and solve drug-related problems related to one topic in self-care/non-prescription drugs			
b. Be able to utilize and adapt the pharmaceutical care process as a systematic approach to self-care counseling			
c. Be able to apply special techniques and appropriate communication skills with patients who may have special need			
d. Be aware of moral, ethical and legal responsibilities and social issues associated with the topic in self-medication			
e. Be knowledgeable of the topic's basic pharmacology and therapeutics			
f. Be aware of the topic's self-medication hazards			
g. Be aware of and able to assess issues for the self-medication related to advertising, consumer perceptions, packaging, in-store promotions, coupons, availability of products, the roles of the pharmacist, organizations, and the manufacturer			
Some Sample Lesson Topics			
● Hypothyroidism	● Osteoporosis	● Insomnia	● Low Back Pain
● Eye Irritation	● Teething and Croup	● Weight Management	● Herpes Labialis
● Kidney Stones	● Skin Aging	● Diabetic Foot	● Pediculosis
● Scabies	● Psoriasis	● Dysmenorrhea	● Cough & Cold
● Menopause	● Special Diets	● Contraception	● Sports Nutrition
● Otitis Externa	● Hemorrhoids	● Pinworms	● Vaginitis
● Eating Disorders and Obesity	● Iron Deficiency Anemia	● Photosensitivity	● Motion Sickness
● Self Care in Pregnancy	● Self Care in Infants	● Self Care in the Elderly	● Constipation
● Dyspepsia	● Traveler's Diarrhea	● Breast Feeding and Infant Nutrition	● Burns: First Aid & Role for Botannicals

Surveys

Students completed online survey instruments 1 month after completion of the course, after grades had been finalized and just prior to students beginning APPEs. Items on the survey instrument administered to the 2009-2010 cohort summarized students' perceptions of the course as a whole in terms of improvement of knowledge and skills through critical reasoning principles. Reflective comments also were solicited concerning 6 aspects of the course: the effect on the way they learned; their responsibility for independent and peer learning; their skill or confidence in terms of readiness to practice; and their preparation to meet the 3 competency standards. Students in the 2009-2010 cohort were asked to rate their critical reasoning experience as well as to explain their perceptions of the experience using a questionnaire that itemized the 3 ACE principles, further delineated into individual aspects (n = 25). Twelve items were rated (scale of 1 to 5; Table 2)

The overall mode for the 4 items that addressed components of agency was 5 (Table 2). The overall mode for the 3 items that addressed components of collaboration was 4. The overall mode for the 5 items that addressed components of expertise was 5. Student rated the course most highly for facilitation of agency and expertise, followed by collaboration. Students in this cohort rated the course highly in terms of enabling critical reasoning. The course design was valued by students in the delivery of overall ACE principles as well as the individual aspects.

After completion of the course, students were asked to comment on how the design affected the way they learned. The instructor rated all notes. The content of free-response notes was rich with comments relevant to ACE principle indicators, with comments indicating the students found the design useful. Qualitative analysis revealed support for agency, collaboration, and expertise in the first 3 sections: the effect on the way they learned; their responsibility for independent and peer learning; their skill or confidence, in

Table 2. Pharmacy Students' Perception of ACE Components in an Online Self-Care Elective Course That Emphasized Self-Directed Learning

ACE Components	Survey Item	Mode Score ^a
Agency		
Constructing their own learning goals selecting assessment measures for self; using reflection and recalibration to enable self-regulation	Student self-direction in advancing ideas / concepts / understanding	5
Determining content	Constructive use and evaluation of authoritative sources	5
Selecting assessment measures for peers	Democratizing knowledge: each participant in the course has an equal voice in self and peer teaching and learning	5
Self-direction and empowerment	Pervasive knowledge building: learning extends beyond a classroom setting to other environments	5
Agency: overall score		5
Collaboration		
Negotiating the concordance of individual ideas with those of peers	Community knowledge as collective responsibility: each participant contributes to the body of knowledge for professional practice of pharmacy	5
Synthesizing and providing community knowledge as a collective responsibility	Symmetric knowledge advancement: self-learning is translated to others: peers, junior classes and inter-professional groups	4
Peer assessment	Transformative assessment: ability to self and peer assess	4
Collaboration: overall score		4
Expertise		
Practice validity	Authentic problems elaborated: valid and practical realistic patient examples	5
Skill in translation of knowledge to others at the appropriate audience level	Knowledge building discussion: provision of teaching and learning feedback	4
Observation of modeling samples which enable heuristic script acquisition (eg, published cases available online)	Improvement of ideas	5
Evaluation skills	Diversity of ideas	4
Confidence in conceptualization, judgments and communication	Conceptual change: ideas that "rise above" current understanding: integrating and synthesizing independent concepts	5
Expertise: overall score		5
Overall score		5

^a Scores based on a 5-point Likert scale.

terms of readiness to practice. Students emphasized the development of skills of self-reflection, self-evaluation which improved learning at every step, and taking active responsibility for individual learning (agency); their contributions to professional development of others, reinforced by peer enthusiasm (collaboration); and increase in confidence through development of many skills (expertise). Comments also reflected students' positive perceptions regarding their preparedness to meet the 3 individual competency standards.

Items on the second survey instrument administered to the 2010-2011 cohort solicited students' perspectives on the 3 assignments in terms of each ACE principle (agency, collaboration, and expertise) using a 5-point Likert scale). The survey instrument also solicited written comments on each of these elements. The mode Likert-scale ratings for the items are given in Table 4. This cohort of students also rated the course highly in terms of enabling critical reasoning. Each

assignment was valued by students in the delivery of overall ACE principles.

For agency, all 3 assignments were rated as 5, with an overall mode of 5 for agency in terms of the assignments. For collaboration, the overall mode was 4. For expertise, the overall mode was 5. In terms of the 3 critical reasoning principles, high scores were achieved for each. In the same pattern as the previous year, students rated the course most highly for facilitation of agency, followed by expertise and then collaboration.

Students also were asked on the same survey tool, to comment about how each of the 3 assignments enabled each ACE principle; if they felt the course impacted their learning or outcomes in other fourth-year courses; and if they felt the course affected their confidence or skills level in terms of beginning experiential courses and later, their practice.

The content of free-response notes was rich with comments indicating the students found the design of value in developing high-order skills, and revealed supports for agency, collaboration, and expertise for all 3 assignments. They emphasized the advances in self-direction and motivation, the support and feedback of peers, and the skills of knowledge transfer to others at an appropriate level required all the qualities of an expert. Comments also reflected their positive perceptions on their preparation for other courses as well as readiness for experiential and practice situations.

Both cohorts of students indicated the course design elicited a broad array of feelings and behaviors consistent with readiness to meet practice competencies through the enablement of ACE principles. They felt genuinely empowered to assess evidence, and make independent choices as to what was pertinent, keeping in mind the needs of a health care professional audience.

Summative peer assessment feedback was collected for this cohort in which they reviewed a peer's completed online case for outcomes and compared it to their own effort. Learner assessment feedback was collected from junior students who had access to the cases as a self-study

resource to supplement their required self-care courses in the second and third year.

DISCUSSION

The purpose of this course was to prepare graduates to meet standards for patient safety, professional development, and collaborative practice. Because 3 principles of critical reasoning—agency, collaboration, and expertise (ACE)—are essential to maintenance of competency in self-regulating professions, the course was designed to be self-directed and delivered online. Graduates of the course over the 2 reported iterations achieved the curricular goals, enabling readiness for practice, through enhancement of transferable critical-reasoning skills applied to critical appraisal, content, metacognitive reflection, assessment, and peer-teaching activities. These levels were set at the highest level of Miller's competency hierarchy (does).

This course design may be applicable in other health care contexts, eg, for increasing student engagement and learning outcomes, particularly in distance or multiple-setting course delivery; and for training practitioners in situations where self-sufficiency is most needed, such as working in relative isolation. The provision of online collaboration with others is especially helpful to the latter group. Computer-assisted learning offers definite student benefits: an interactive experience in a convenient, time-efficient manner, a cost-effective alternative to classroom learning, a bridge to practice enabling student teaching in continuing education, and the ability to reach significant numbers of learners in a variety of interprofessional settings and stages of training.

This integrative course tests the ability of students to transfer prior knowledge and synthesize and evaluate relevant content into a new context. It provides a design that enables deep constructivism and situated learning in a self-directed yet collaborative approach that extends from the undergraduate to the continuing education audience. As such, it fulfills all the design requirements of advanced problem-based learning challenges for educational practice

Table 3. Pharmacy Students' Perceptions of Their Preparedness in the Three Areas After Completing an Online Self-Care Elective Course That Emphasized Self-Directed Learning

Assignment	Critical Reasoning Component, Mode Score		
	Agency	Collaboration	Expertise
Critical appraisal and annotated bibliography	5	4	5
Learning objectives; flowchart; abstract; test file; completion of one published sample interactive case	5	4	4
Completion of interactive, case-based integrated online lesson	5	4	5
Overall modes	5	4	5

as elaborated by Dolman and colleagues.² This course design has not been previously presented in the literature; thus, it may fill a gap with respect to a cost-effective and efficient way to promote student self-regulation in integrating knowledge and skills to achieve exit curriculum goals. The acronym ACE is a novel and easy way to remember the components of critical reasoning, as it is also an idiom that connotes an excellent student.

The main objectives for the course were achieved. The success of the course is evident from reactions the instructor received from students and peer faculty members. Students make requests to repeat this elective and there is always a waiting list due to course enrollment quotas (N = 25). The instructor has received several requests to present the course to other faculty members as an example of teaching through critical reasoning.

In both cohorts, students rated all 3 course abilities to enable individual ACE principles strongly, with agency highest, followed by expertise and then collaboration. Receiving the highest ratings for agency is reasonable given the self-directed nature of the course. This facilitated expertise, enabled to various degrees by all 3 components. Collaboration was encouraged through the review of model cases, contribution to professional development by delivery of a peer teaching case, and through summative peer assessment of peer completed lessons.

Strong ratings for each of these skills contributed to perceptions of advances made in key competency standards relevant to the course: patient safety, professional development, and collaborative practice. Agency and expertise are particularly important to professional development, while collaboration directly relates to the ability to be competent practicing with others.

The course required a lot of collaborative and synthesized knowledge that can be used by others. Students were left with a much clearer understanding of how to select, appraise, and apply evidence to a therapeutic topic in a format that provided a sustainable online teaching platform for other health professional communities to deliver best-practice patient care.

Students sent a clear message that the self-directed active learning and peer teaching was transformative for them in terms of building knowledge and critical reasoning skills as well as preparation for competency standards; and were preferred to other fourth-year PBL course formats. Furthermore, delivery of course objectives in an appealing format through a design that cannot be duplicated by texts or lectures resulted in a positive student experience, as enjoyment enhances learning.

The instructor has received a variety of other feedback on the course. Summative peer assessment feedback was collected for the 2010-2011 cohort in which they reviewed

a peer's completed online case for outcomes, compared it to their own effort and gave suggestions for refinements. Learner assessment feedback was collected from junior students who had access to the cases as a self-study resource to supplement their required self-care courses in second and third year. All agreed that online cases were an engaging, more interesting way to learn and believed they could be used as an effective topic introduction, study supplement, or resource for concepts and consideration of different patient populations. Some expressed a desire to create an online case. Finally, unsolicited and informal feedback from peer faculty members has been received following presentations of this course as a professional development session on critical reasoning, indicating it was a model of great interest and importance to the faculty, practically useful, theoretically interesting, and enhanced the quality of learning in the pharmacy program.

The initial course launched in 2004 has undergone 7 revisions based on constructive criticisms and realistic self, peer, and student feedback. Modifications have been made to lesson planning (reversed sequencing of flow-chart vs. bibliography assignments, addition of critical appraisal and annotations to bibliography, group tutorials, discussion forum); lesson structure (addition of four elements: metacognitive feedback, levels of learning objectives, transition statements and post-test questions); and evaluations of course outcomes (addition of student surveys to assess practice competencies and course success).

The course may entail iterative revisions for future cohorts if so indicated by learner feedback. The current offering did not dictate significant changes were necessary for the next year which is reflective of past refinements and sustainability over time. The instructor had asked students for their perceptions of competency readiness only at the end of the course, with the practice experience imminent. A pre-course administration of the same test would be useful in showing any change in perception and is planned for the next course iteration.

Anticipated barriers were circumvented through online instructions and models, group tutorials, test samples, and instructor feedback. No major problems with the instructional design were encountered. Minor issues with connectivity or instructions were easily resolved.

The primary issue was the time demands on the instructor who did not have teaching assistants. A limited enrollment was therefore imposed for the course. The instructor's time included the hours for design modifications, programming of surveys, instructions and submission pages; review of database submissions; responses to student questions or technological problems; and tabulation of survey results.

SUMMARY

This senior course is a unique advance in curriculum design because of its self-regulated online format. It integrates and applies content and skills learned in prerequisite and co-requisite courses, presenting therapeutic topics in new contexts that are comprehensive and inclusive as well as relevant to future practice. Appropriate measurements for curriculum design were applied and reported in terms of positive outcomes in performance on examinations, and survey feedback. This structure allowed students to meet stated goals of preparing for practice competencies in patient safety, professional development, and collaborative practice. Through the 3 assignments, which encouraged critical reasoning, advances were made in terms of agency, collaboration, and expertise. It has proven to be an effective curriculum course design, with no limitations beyond time commitments or connectivity issues. The design is functional without undue complexity, and alterations in the format template, assignment components, or assessment rubrics, can be made as necessary. The course easily could be duplicated or adapted by other educators in other settings for other audiences.

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