

INSTRUCTIONAL DESIGN AND ASSESSMENT

Impact of Student- Versus Instructor-Directed Case Discussions on Student Performance in a Pharmacotherapy Capstone Course

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Objective. To evaluate the impact of incorporating student-directed (SD) vs instructor-directed (ID) active learning on student performance in a pharmacotherapy capstone course.

Design. This 9-credit course was redesigned from exclusively ID case discussions to a format in which half were SD and half were ID. Student performance on evaluation questions derived from SD sessions was compared with that from ID sessions.

Assessment. Overall, students (n=299) performed better on ID-session questions than on SD-session questions (78.7% vs 75.3%, correctly answered, respectively; $p < 0.001$). For written evaluations, students performed better on ID-session questions than on SD-session questions (79.8% vs 73.9%, respectively; $p < 0.001$). For verbal evaluations, students performed better on SD-session questions than on ID-session questions (79.5% vs 74.5%, respectively; $p < 0.001$). After the course revision, student confidence regarding their ability to think critically, solve problems, make decisions, and pursue lifelong learning was high, and student and faculty feedback was positive.

Conclusion. Student performance in a pharmacotherapy capstone course remained acceptable when a combination of SD and ID active learning was used, but the addition of SD learning did not translate to better performance on course evaluations.

Keywords: active-learning, self-directed learning, lifelong learning, capstone course, pharmacotherapy

INTRODUCTION

Self-directed learning skills are associated with lifelong learning and are particularly important in fields such as pharmacy wherein knowledge is continuously changing.¹⁻⁶ Contemporary pharmacy practice environments also require pharmacists to have strong critical-thinking, problem-solving, and independent-learning skills. Pharmacists entering the workforce must be able to participate in continuing professional development, a reflective and directed approach to professional growth.⁷ They also must be able to direct and regulate their own continuous learning experience in order to maintain professional competency and effectively synthesize and apply knowledge to individualized patients.

The doctor of pharmacy (PharmD) degree curriculum at the University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences is guided by the program's educational ability-based outcomes. One outcome expected from pharmacy graduates is the maintenance of professional competency and professional stewardship. Graduates are expected to be able to (1) identify and analyze emerging issues (including basic and clinical scientific advances), products, and services to improve pharmacy practice and public health; and (2) self-assess learning needs and design, implement, and evaluate strategies to promote intellectual growth and continued professional competence.

These lifelong, independent-learning skills are challenging to teach in a traditional classroom environment. The best way to address this outcome in the current curriculum is unclear. Some literature suggests that active-learning models enhance or improve student learning and comprehension compared with more traditional, passive-learning models.¹⁻⁴ In addition, students participating in self-directed learning activities take greater initiative and

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control of their learning and achieve better clinical performance in the experiential components of their educational programs.^{5,6}

Developing, implementing, and evaluating new approaches to classroom learning that may improve independent-learning, critical-thinking, and problem-solving skills are crucial for the continued development and improvement of the PharmD curriculum. These approaches are also supported by the Accreditation Council for Pharmacy Education standards and the Center for the Advancement for Pharmaceutical Education outcome statements, which require programs to use teaching and learning methods that enable students to transition from dependent to active, self-directed, lifelong learners.^{8,9}

This paper describes changes made to the instructional design and learning environment within a pharmacotherapy capstone course. The approach to teaching and learning in the course was revised in 2009 in an attempt to incorporate more student-directed (SD) active-learning sessions. The purpose of this study was to evaluate how incorporating SD active-learning activities into the course impacted student performance on students' course evaluations and confidence levels.

DESIGN

This instructional design change occurred in a required 1-semester, 9-credit, case-based capstone course called "Comprehensive Patient Care" (CPC), which is taken in the second semester of the third year of the PharmD program. This course is the last required course prior to advanced pharmacy practice experiences (APPEs), occurs immediately after completion of the pharmacotherapy course series, and is considered the most intensive course in the PharmD program at our institution. The course exposes students to patient cases within settings, timeframes, and situations that are designed to simulate real patient-care environments and activities that are experienced in the fourth year. The major themes of the course outcomes for this pharmacotherapy capstone course relate to providing appropriate pharmacotherapy assessments and recommendations that are evidence-based, communicating effectively, and engaging in self-directed, active learning. The expected outcome of the instructional design change related to self-directed learning in the course was to improve student performance and confidence levels, and ultimately to improve students' abilities to think critically, solve problems, and learn independently.

Since its creation in 2002, several guiding philosophies have served as the foundation of this course and have been used to design the course structure. These guiding philosophies are intended to provide learning experiences and evaluations that mirror real-life clinical scenarios (eg,

cases, application of evidence, patient presentations); use active-learning methodologies; reintroduce therapeutic topics that had been previously taught in the curriculum using plausible, integrated, and complex patient cases; enable and expect students to learn independently and from peers; enable students to routinely self-assess performance; require students to conduct themselves in a professional manner (eg, be respectful, ethical, prompt, and effective with teamwork, evaluate patient cases with realistic expectations); and require that student conduct and performance are consistent with what is expected in APPEs and in pharmacy practice.

Each class session involves a discussion about a complex patient case. Over the course of the semester, students evaluate roughly 30 case scenarios, each including 2 to 4 high-priority diseases or pharmacotherapy-related problems. Cases are available to students electronically at least 48 hours prior to each class session. Patient case documents simulate real-world electronic health records. Students are responsible for evaluating the patient cases prior to class and are expected to be well-prepared and to participate actively in the class discussions. Doing so requires students to independently review prerequisite pharmacotherapy and disease-state management knowledge and complete a prioritized problem list with an assessment and plan for each high- and medium-priority problem using a standardized written patient case worksheet. Students are expected to apply knowledge from previous coursework and to evaluate new literature and evidence that may affect disease-state management (eg, updated national treatment guidelines, landmark clinical trials). No new therapeutic topics are included in the patient cases, and there are no classroom lectures. Although the course requires preparation and study time outside of class, which varies greatly among students, time requirements outside of class are expected to exceed time spent in class sessions.

Although the course has evolved in multiple ways over the last decade, the focus of this paper is solely on the instructional design change made in 2009. The course was redesigned from being exclusively instructor-directed (ID) case discussions to a model in which half of case discussions were SD and half ID. All cases, in both SD and ID sessions, were developed by faculty members who were content experts and required similar preparation by the students outside of class. Both SD and ID sessions varied in terms of disease states, practice settings, and difficulty level. There was minimal to no overlap of disease-state topics between SD and ID sessions, and the sessions were conducted differently.

SD sessions were primarily long-case sessions, during which students followed a patient case over time and over 3 to 4 class sessions. The SD-session cases were developed

by course directors. Sessions were held in smaller rooms with groups of 14 students and were led by students with limited instructor facilitation. With a class size of 130 to 160 students, 12 groups were formed with 1 facilitator per group. The students were responsible for leading the case discussion. Students took turns leading and participating in the group discussion. A primary purpose of these sessions was self-directed learning, and each student was expected to engage in the discussion throughout the entire session. The faculty facilitator's primary responsibilities were to evaluate the participation of each student, to encourage sufficient depth and breadth of topic discussion, and to maintain time restrictions. Although facilitators did not provide groups with answers, they were trained to redirect the groups if they deviated substantially from a reasonable plan.

ID sessions were primarily short-case sessions during which students evaluated a patient case at only 1 time point and at only 1 session. The ID-session cases were developed by faculty instructors, some of whom were also course directors, and were held in lecture classrooms. The faculty instructor was a content expert, who was responsible for directing a group of approximately 35 students through the case discussion. Given the large class size, the faculty instructor had to facilitate the ID case discussion 4 separate times. A primary purpose of these sessions was to have the instructor model the thought process and therapeutic discussion of a focused patient case. The instructor led the group through the case by modeling but engaged students in the discussion. Although students were expected to be prepared and to engage in the discussion throughout the entire session, participation was not evaluated. The instructor provided guidance throughout the session and offered key take-home messages.

There were 10 evaluations in the course: 3 written evaluations, 3 verbal case presentations, 3 verbal question evaluations, and 1 cumulative-participation evaluation

(Table 1). All evaluations were graded as pass or fail. The verbal case presentations assessed knowledge and application of pharmacotherapy content that was included only in the SD sessions. The written and verbal question evaluations assessed knowledge and application of pharmacotherapy content that was included in both the SD and ID sessions. The participation evaluation directly assessed individual student engagement in the SD sessions.

There were 139 third-year PharmD students enrolled in the course in spring 2010 and 160 in spring 2011. The course was directed by 6 senior faculty members (associate or full professors), all of whom were board-certified pharmacotherapy specialists and practicing clinical pharmacists. Three teaching assistants provided logistical support for evaluations. Students were in class for approximately 9 hours per week, and their time requirements outside of class were expected to exceed the time they spent in class. The course required multiple classrooms, including 12 concurrent, small-group classrooms with 12 to 16 seats 2 to 3 times per week, one to two 80-seat classrooms 2 to 3 times per week, and one 200-seat classroom intermittently. It also required course directors and additional faculty members to facilitate the SD and ID case discussions at least twice per week as well as faculty members to participate in verbal evaluations (20 faculty members for each of the three 3-hour verbal evaluations). The verbal evaluations were standardized, all faculty members were trained, and evaluation scores were reviewed by the course directors to ensure objectivity and consistency in grading.

EVALUATION AND ASSESSMENT

This was a retrospective, cohort study of 299 students (n=139 for spring 2010 and n=160 for spring 2011) who successfully completed the capstone course. Confidential student information was de-identified, and results were evaluated by the course directors. Student performance on evaluations and student self-assessments of confidence

Table 1. Evaluation Structure for Comprehensive Patient Care in a Pharmacotherapy Capstone Course Involving Instructor-Directed and Student-Directed Learning

Evaluation Type	Structure of Evaluation
Written examination	Approximately 30 short-answer knowledge and application questions, including evidence-based assessments or plans for case vignettes.
Verbal case presentation	Student has 1 hour to prepare an assessment and plan for 2 high priority problems from a patient case. Student performs 5-minute presentation on patient information, assessment, and plan for 1 of the 2 high-priority problems.
Verbal-questions	Student is asked 10 questions on disease- or drug-related issues.
Participation	Student is evaluated using a participation rubric by a faculty facilitator on level of engagement, quality of contribution, and professional behavior during each student-directed session.

were used to assess the impact of incorporating SD learning activities in the course.

Student performance was evaluated through a total of 10 evaluations as a regular course requirement. Because the 3 verbal-case presentations included content only from the ID sessions and the participation evaluation included participation in SD sessions only, they were excluded from the study evaluation. The other 6 evaluations (3 written and 3 verbal-question evaluations) included in the study had components from both SD and ID sessions. Individual questions on each of these 6 evaluations were graded as correct or incorrect. Student performance was evaluated to determine the percentage of questions answered correctly. Questions from the 6 evaluations were categorized retrospectively by the 6 course directors as content derived from either SD or ID sessions. Questions were also categorized retrospectively as knowledge-based or application-based questions by consensus of the 6 course directors. Student performance on content from SD sessions was compared with that of ID sessions, and student performance on knowledge-based questions was compared with that on application-based questions.

The impact of the course on student confidence levels related to critical-thinking, problem-solving, decision-making, and lifelong learning was evaluated using a 4-item survey instrument immediately after taking the course and 6 months later during APPEs. Student and faculty member perceptions about the course were assessed through standardized university course evaluations and faculty member self-assessments at the end of the semester. Student course evaluations consisted of 25 questions related to the perceived benefit of course outcomes, materials, structure/format, and educational activities using a 5-point Likert

scale as well as open-ended questions regarding positive aspects of the course and suggestions for improvement. Course director assessments included 7 questions directly related to the outcomes of this study using a 5-point Likert scale and an open-ended comments section.

Chi-squared analysis was used for comparing evaluation data. The Mann-Whitney U test was used for student confidence data. This study was approved by the Colorado Multiple Institutional Review Board.

The analysis included 387 questions: 207 were written evaluation questions and 180 were verbal-evaluation questions; 203 were application-based questions and 184 were knowledge-based questions; and 187 were derived from ID sessions and 200 were derived from SD sessions (Figure 1). Performance on evaluation questions was acceptable, with correct responses on 77%. Students performed better on questions derived from ID sessions than on questions derived from SD sessions (78.7% vs 75.3% correct responses, respectively; $p < 0.001$, Figure 2). For written evaluation questions, students also performed better on ID-session questions compared with SD-session questions (79.8% vs 73.9%, respectively; $p < 0.001$). In contrast, on verbal-evaluation questions, students performed better on SD-session questions than on ID-session questions (79.5% vs 74.5%, respectively; $p < 0.001$). Student performance was better on written knowledge-based questions than on written application-based questions from both SD and ID sessions ($p < 0.001$ for both comparisons; Figure 3). Performance differences between SD- and ID-session questions were most pronounced on written knowledge-based questions, with higher performance on questions derived from ID sessions than on SD sessions (87% vs. 75.3%, respectively; $p < 0.001$). Students

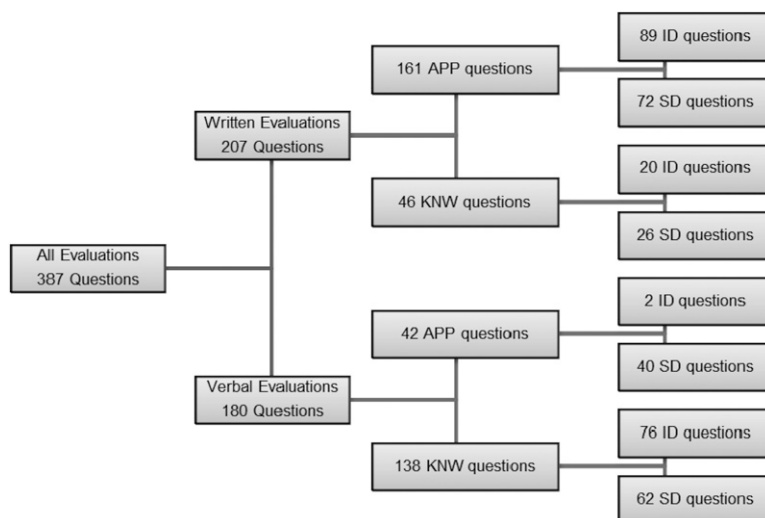


Figure 1. Evaluation Components in a Pharmacotherapy Capstone Course Incorporating Instructor-Directed and Student-Directed Learning. Abbreviations: APP=application-based; KNW=knowledge-based; ID=instructor-directed; SD=student-directed.

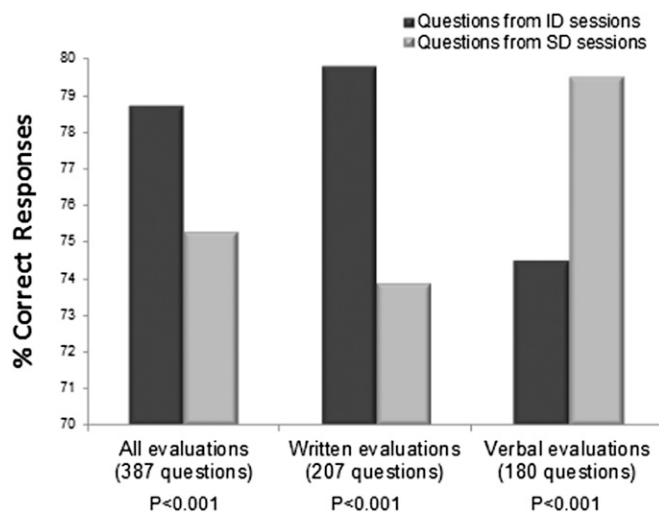


Figure 2. Student Performance on Evaluations in a Pharmacotherapy Capstone Course Involving Instructor-Directed and Student-Directed Active Learning. Abbreviations: ID=instructor-directed; SD=student-directed.

performed better on verbal knowledge-based questions derived from SD sessions than on ID sessions (76.9% vs 74.0%, respectively; $p < 0.001$). There was an insufficient number of verbal application-based questions to evaluate differences between student performance on content from SD sessions and that from ID sessions.

Two hundred seventy-one students (91%) completed the 4-item confidence questionnaire immediately after taking the course, and 267 students (89%) completed it

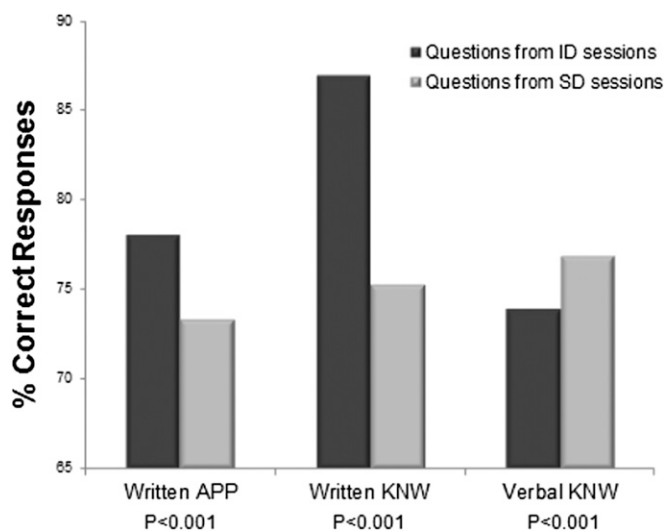


Figure 3. Student Performance on Application vs Knowledge-Based Questions in a Pharmacotherapy Capstone Course Involving Instructor-Directed and Student-Directed Learning. Abbreviations: ID=instructor-directed; SD=student-directed; APP=application-based; KNW=knowledge-based.

again 6 months later during APPEs. A high percentage of students strongly agreed or agreed that they were more confident in their abilities to critically think, solve problems, make decisions, and pursue lifelong learning immediately after completing the CPC course (Table 2.) These attitudes persisted over time, with a high percentage of students strongly agreeing or agreeing 6 months later during APPEs. There were no significant differences between mean scores on evaluations taken immediately after the course and those taken 6 months later.

Two hundred seventy-one students (91%) completed the standard university course evaluation (133 in spring 2010 and 138 in spring 2011). Mean scores on the 5-point Likert scale (5=strongly agree to 1=strongly disagree) ranged from 3.8 to 4.3. Eighty-five percent of students strongly agreed or agreed that the course structure and format facilitated their ability to apply principles of patient care to patients. Eighty-five percent of students strongly agreed or agreed that the course activities facilitated learning. Eighty percent of students strongly agreed or agreed that the educational activities helped raise awareness of professional expectations relevant to pharmacy practice. Eighty-three percent of students strongly agreed or agreed that educational activities helped them better comprehend the expectations of APPEs. The lowest score was related to the balance of work inside and outside of class; 70% of students strongly agreed or agreed that the course structure or format allowed for reasonably well-balanced work inside and outside of class. Although course evaluation results were positive, student comments revealed little to no previous exposure to self-directed learning expectations in the curriculum, and some comments reflected resistance to this change in instruction design.

The 6 course directors (100%) completed self-assessments of the course (Table 3). The course was viewed as effective and successful at meeting its outcomes. The change in course design was assessed positively by the course directors, with all agreeing or strongly agreeing that incorporating SD sessions into the course improved student abilities to make decisions, learn independently, and pursue lifelong learning. There was less agreement regarding whether incorporating SD sessions improved student abilities to think critically and solve problems and even less agreement regarding whether the change in course design improved performance on evaluations. All course directors endorsed the major changes to the instructional design of this course.

DISCUSSION

This pharmacotherapy capstone course incorporated a student-directed educational component in an attempt to improve student performance on course evaluations,

Table 2. Student Self-Assessed Confidence Following a Pharmacotherapy Capstone Course Involving Instructor-Directed and Student-Directed Learning, As Measured Immediately After the Course (n=271) and 6 Months Later (n=267)

Area of Confidence	Responses, No.					Mean Score ^a (SD)	P ^b
	Strongly Agree, No. (%)	Agree, No. (%)	Neither Agree/Disagree, No. (%)	Disagree, No. (%)	Strongly Disagree, No. (%)		
Critically think							
Immediately after	84 (31)	141 (52)	35 (13)	3 (1)	8 (3)	4.1 (0.9)	0.44
Six months later	79 (30)	162 (61)	18 (7)	8 (3)	0	4.2 (0.7)	
Problem solve							
Immediately after	80 (30)	141 (52)	38 (14)	4 (1)	8 (3)	4.0 (0.9)	0.28
Six months later	82 (31)	152 (57)	25 (9)	8 (3)	0	4.2 (0.7)	
Make decisions							
Immediately after	77 (28)	143 (53)	38 (14)	5 (2)	8 (3)	4.0 (0.9)	0.68
Six months later	74 (28)	152 (57)	31 (12)	9 (3)	1 (0)	4.1 (0.8)	
Pursue lifelong learning							
Immediately after	78 (29)	140 (52)	41 (15)	4 (1)	8 (3)	4.0 (0.9)	0.40
Six months later	83 (31)	140 (52)	34 (13)	10 (4)	0	4.1 (0.8)	

^a Mean score based on responses on 5-point Likert scale on which strongly agree=5, agree=4, neither agree/disagree=3, disagree=2, strongly disagree=1.

^b Comparison between mean score immediately after the course and 6 months later.

increase student confidence, meet the course outcomes, and ultimately improve students' abilities to think critically, solve problems, and learn independently. There was acceptable performance on course evaluations after the learning model was changed to a combination of SD and ID case-based sessions. We believe that that the students met the course outcomes in this SD and ID case-based format, based on their acceptable performance on evaluations, which had been designed and refined over a decade to accurately measure course outcomes. However, the SD educational model did not result in improved or higher performance on evaluations. Student performance on evaluations was better with ID sessions than with SD sessions, which differed from one another in evaluation

format (written vs verbal) and type of evaluation question (knowledge- or application-based).

Student performance on evaluations cannot be used to directly assess the impact of this course on the outcome of lifelong learning skills. Faculty member assessments of student participation (data not shown) ensured that students were engaged in SD sessions, and course director assessments revealed that faculty members perceived that SD learning activities improved student abilities to learn independently. While the course directors endorsed the idea that the ability to learn independently may translate to lifelong learning, a skill that is believed to be invaluable in pharmacy practice, they did not uniformly believe that the current course evaluations sufficiently evaluate

Table 3. Course Director Assessments of the Impact of Incorporating Student-Directed Sessions Into a Pharmacotherapy Capstone Course Involving Instructor-Directed and Student-Directed Learning (n=6)

Areas of Assessment	Responses, No.					Mean Score ^a
	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree	
Incorporating student-directed sessions into the course improved...						
Student performance on verbal question evaluations.	0	2	4	0	0	3.3
Student performance on verbal case evaluations.	0	5	1	0	0	3.8
Student performance on written evaluations.	0	1	4	1	0	3.0
Student abilities to critically think.	1	4	1	0	0	4.0
Student abilities to problem solve.	2	3	1	0	0	4.2
Student abilities to make decisions.	3	3	0	0	0	4.5
Student abilities to learn independently.	4	2	0	0	0	4.7
Student abilities to pursue life-long learning.	3	3	0	0	0	4.5

^a Based on Likert scale on which strongly agree=5, agree=4, neither agree nor disagree=3, disagree=2, strongly disagree=1.

or predict a student's ability to pursue lifelong learning. However, this model of instructional design has been endorsed by virtue of the pharmacotherapy capstone course maintaining this structure.

Differing results between verbal and written evaluations may have occurred because SD learning activities were primarily verbal group discussions whereas ID learning activities included a large component of writing on the board and, thus, may have had more instructor guidance and less student participation. It is unclear why student performance on written evaluation questions, both knowledge- and application-based, were higher for ID-session questions than on SD-session questions. It may simply be that the ID sessions provided students with a more structured refresher on the disease state. Additionally, there may have been more consistency of information presented in ID sessions compared with SD sessions, in which students may have had different learning experiences within small SD groups. Instructors in the ID sessions were able to close the loop regarding a particular assessment or plan of a disease state, thus giving students more clear guidance regarding reasonable therapeutic options. In the SD sessions, reasonable therapeutic options may have been more vague. To overcome this limitation in subsequent offerings of the course, we added full-class debrief sessions after each SD long case so that key concepts could be discussed with the entire class. This change, which was implemented after this study, has been well received by students.

Implementing an SD component to this capstone course was challenging. Both students and faculty members resisted this educational approach. Student comments on course evaluations suggested a preference for the ID approach over the SD approach. Students indicated that they were satisfied in the ID sessions because content experts directly shared their opinions regarding case discussions but did not feel this way regarding the SD sessions. Faculty facilitators were challenged to encourage and enable student engagement in the SD session. Given that students were accustomed to the ID approach to this course since its inception in 2002, it was not surprising that they approached the SD sessions with reluctance. Reverting to solely ID sessions can be tempting to faculty members because they are more efficient to implement and require fewer faculty instructors. Further, it is not necessary to assure consistency among various instructors in ID sessions as it is in SD sessions. Facilitators in SD sessions are directed to facilitate rather than lecture, not to give answers, and to hold students accountable for engaging and directing sessions. Despite these challenges, course directors have chosen to continue the SD components of this pharmacotherapy capstone course based on the belief that it is the optimal approach to meet the course outcomes.

The lowest score on student course evaluations was in response to the following statement: "Course structure/format allowed for work inside and outside of class time to be reasonably well balanced." Several students commented that they spent much more time preparing for class than they ever had previously in the program. This was likely attributable, at least in part, to the course being worth about twice as many credits as most courses they had been exposed to and the fact that students had little exposure to SD learning prior to this course. This observation demonstrated a need to modify our pre-CPC curriculum to introduce this learning strategy earlier in the curriculum.

There were limitations to the study. Variability within the course may have confounded the results, including year-to-year variability of evaluation questions, instructors, cases, and disease-related problems. Course evaluation questions were developed by the content expert. Knowledge questions from ID sessions may have been directly related to content that they knew was covered in the session, thus resulting in higher scores compared with SD sessions, where the content expert may have asked more global or application-type questions that all students should have discussed in their groups. Other changes made to the course between 2010 and 2011, such as incorporating practice evaluation sessions, also may have confounded the results.

SUMMARY

The instructional design of our pharmacotherapy capstone course was changed to include both SD and ID case-based learning in an attempt to improve students' independent-learning and critical-thinking skills. Student performance on evaluation components from both SD and ID material remained acceptable after this change, but the SD model did not result in improved or higher performance. Confidence levels related to critical-thinking, problem-solving, decision-making, and lifelong learning were high as a result of the course. Knowledge gained from this study could apply to any course that employs traditional, classroom learning models or any educational program that aims to develop graduates with independent-learning skills. SD learning imparts skills and abilities that cannot be easily measured through written or verbal evaluations. Students' confidence in their learning ability through this method indicates that it is an effective teaching method.

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