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## Design of a Problem-Based Learning Pain and Palliative Care Elective Course

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# Design of a Problem-Based Learning Pain and Palliative Care Elective Course

## Abstract

### Objective

To implement and evaluate a problem-based learning (PBL) pain and palliative care elective course to develop students' pain and symptom management pharmacotherapy knowledge, clinical reasoning process, and self-directed learning skills.

### Methods

Each week students received a patient case to independently develop an assessment and plan for each pain and symptom management problem. During class the students discussed their findings within small groups in preparation for a large-group discussion with the instructor. Students' course grades were based on weekly pre-class case preparation, individual case studies, and self-reflection questions. To assess knowledge gained over the semester a free-response pre- and post-course test was given.

### Results

Twenty-five students enrolled in this course. A *t*-test comparison of the pre- and post-tests yielded a significant difference between the pre- and post-test scores ( $p < 0.001$ ), with the mean score for the tests increasing from 9.6 (out of 20 points) on the pre-test to 14.1 on the post-test. Pearson's correlation coefficient between the pre- and post-test was 0.45, indicating increased scores were not a result of improvement only among the strong students. The normalized gain was 0.43. The average score for each individual case study was slightly more than 80%. Four themes were noted in the students' self-reflections including patient/family goals of care, individualization of patient care and contrast to curative treatment, improved comfort with "gray therapeutic areas," and advantages and disadvantages of problem-based learning.

### Conclusions

Students demonstrated improved pain and symptom management pharmacotherapy knowledge, clinical reasoning process, and self-directed learning skills after course completion. The skills developed by students will benefit them in future clinical practice. Additional studies are needed to assess the long-term impact of the skills developed in this course.

### Keywords

Problem-based learning, Pain, Palliative Care, Pharmacy, Elective

### Disciplines

Pharmacy and Pharmaceutical Sciences

### Comments

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22 **Keywords:** problem based learning, pain, palliative care, pharmacy, elective

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26 **Introduction/Background**

1           There is increased awareness on the need to improve pain and palliative care content within the  
2 current doctor of pharmacy curriculum as evidenced by its inclusion in Appendix B of the Accreditation  
3 Council for Pharmaceutical Education (ACPE) Standards 2.0.<sup>1</sup> Pharmacists interact with pain and  
4 palliative care patients and caregivers across care settings such as community pharmacies, hospitals,  
5 ambulatory care clinics, and long-term care. They frequently have the opportunity to participate in the  
6 care of patients' requiring pain and symptom management. However pharmacists report a lack of  
7 confidence and inadequate therapeutics knowledge to effectively contribute to community palliative care  
8 services and do not want to become a barrier to quality care.<sup>2,3</sup> A survey of Pharmacy Practice Chairs in  
9 2001 revealed that the didactic curriculum in pharmacy schools averaged  $3.89 \pm 1.91$  lecture hours for  
10 end-of-life care (EOLC).<sup>4</sup>

11           Preclinical years are an ideal time to introduce EOLC concepts to students as they begin to form  
12 their professional identities. The knowledge, skills, and attitudes they cultivate at this stage of their  
13 training will positively or negatively impact their future EOLC perceptions.<sup>5</sup> Similar foundations in basic  
14 sciences, interpersonal skills, empathy, technical competence, and interworkings of the health care  
15 system are needed to provide quality care in EOLC as well as others areas of medicine. Trainees are  
16 also introduced to EOLC's hidden curriculum. They are challenged to consider their visions and  
17 expectations, medicine's emphasis on curing disease versus symptom palliation for patients with  
18 incurable conditions, and how technical competency is more valued than relational competency.

19           The Pain and Palliative Care Strategic Planning Summit recommendations advocate for research  
20 and innovation in pain and palliative care teaching methods and curricular design including case study  
21 development and pedagogical models which encourage interprofessional pain and palliative care  
22 learning.<sup>6</sup> Problem based learning fits this criteria. The ACPE Standards 2.0 Guideline 11 discuss the  
23 need for students to develop critical thinking and problem solving skills and encourage use of active  
24 learning methods such as case studies with the goal to develop self-directed, lifelong learners.<sup>1</sup> This  
25 guideline implies that lecture is not optimal to develop critical thinking skills.

26           Problem based learning (PBL) is an active learning strategy within the medical, pharmacy,  
27 nursing, and science education literature that appears to be effective for developing case based

1 reasoning (CBR) in students who will translate it into future practice. The CBR process includes retrieving  
2 most similar case or cases from a clinician's memory, reusing information and knowledge from similar  
3 cases, determining a solution, and retaining the experience and outcome for future problem solving as  
4 well as the ability to modify a solution to fit new cases. Experience gained from successfully solved  
5 problems is retained for future situations, while the reason for failure is identified and avoided in the  
6 future.<sup>7</sup> This process is beneficial to develop expertise by combining textbook knowledge with  
7 experiences and can be applied to therapeutics and diagnostics.

8 Skills developed using PBL in preclinical years translate into clinical training. PBL develops  
9 higher level learning skills such as clinical reasoning, self directed learning, and independent and critical  
10 thinking skills.<sup>9</sup> Students learn to determine whether additional knowledge or skills are needed to provide  
11 better patient care and the process to most effectively and efficiently obtain information from available  
12 resources. Development of self-directed learning skills is emphasized to provide the foundation for  
13 trainees to modify and expand their knowledge and skills to keep up with practice changes and evidence  
14 based medicine. Students are encouraged to challenge each others' observations, thoughts, and defend  
15 their viewpoints during small group sessions.

16 PBL fits with the multidimensional and longitudinal nature of EOLC.<sup>5</sup> A patient case may evolve  
17 to reflect changing goals of care as a patient transitions from curative and disease modifying treatment to  
18 palliation and may include physical symptoms, psychosocial issues, as well as spiritual and ethical  
19 concerns. Small group discussions can emphasize the clinical, scientific, and personal aspects of  
20 hospice and palliative care. PBL is also able to stimulate challenges and different goals of care for acute,  
21 chronic, and cancer pain management within patient cases.<sup>176</sup> PBL problems often have multiple  
22 potential answers and available resources to derive the solution which fits well with pain and symptom  
23 management pharmacotherapy. Descriptive examples utilizing PBL for pain and palliative care education  
24 include pharmacy student participation within an interprofessional palliative care elective course.<sup>176,187,198</sup>  
25 However, there is a lack of available evidence discussing PBL for teaching pain and palliative care  
26 pharmacotherapy to pharmacy students. A PBL pain and palliative care elective course offers greater

1 material depth and breadth than normally possible within the required didactic curriculum and strives to  
2 develop students' clinical reasoning process and self-directed learning skills.

3

#### 4 **Rationale and Objectives:**

5           The pain and palliative care elective course was first offered to second (P2) and third year (P3)  
6 pharmacy students during the fall 2010 semester. The 2 credit elective met weekly for 1 hour and 50  
7 minutes. One clinical faculty member who specializes in pain and palliative care coordinated the class  
8 and taught drug information and pharmacotherapy topics for 13 of the 15 weeks. The remaining 2  
9 classes on ethics and palliative sedation were team taught with another pharmacy faculty member who  
10 teaches law and ethics. Course materials including the syllabus, supplemental readings, in-class case  
11 studies, and assignments were posted on the St. John Fisher College (SJFC) web-based course delivery  
12 system. The course textbook was the *American Academy of Hospice and Palliative Medicine (AAHPM)*  
13 *Primer of Palliative Care 5<sup>th</sup> Edition (2010)*.

14           The problem based learning (PBL) method utilized for the pain and palliative care elective class  
15 was a modified case-based method as defined by Barrow's problem-based learning methods taxonomy.<sup>10</sup>  
16 The modified case-based method differs from traditional PBL in that there is less free inquiry. Fewer  
17 opportunities for clinical reasoning process and self-directed learning skill development exist than with  
18 traditional PBL when subjective and objective data is provided. Unlike clinical practice, students do not  
19 know what additional assessment information is needed or how to obtain it. However, it is a strong  
20 teaching method for structuring knowledge for use in clinical contexts and increasing motivation for  
21 learning. Given the students lack of PBL exposure elsewhere in the curriculum, the course coordinator  
22 thought that the modified case-based method would be a more familiar format to students because it is  
23 similar to our required Therapeutics Case Studies course and produce less resistance among the  
24 students than the traditional PBL format. The course coordinator wanted to introduce PBL into the  
25 curriculum as a means to develop students' clinical reasoning process, self-directed learning skills, and  
26 realization that clinical problems frequently have multiple reasonable solutions.

1           The course coordinator explained the case based learning process, course goals, and learning  
2 objectives to the students during the first class. The course goals were for students to gain an  
3 understanding of potential pain and symptom management treatments for patients with advanced illness  
4 as well as refine their critical thinking skills and ability to individual drug therapy for a specific patient's  
5 needs. Course learning objectives are discussed in Table 1 and were designed using Fink's taxonomy.<sup>20</sup>

6

## 7 **Materials and Methods:**

8           Patient cases for in-class discussion were posted on the course website one week prior to class  
9 and included relevant subjective and objective data. An example individual patient case is included in  
10 Appendix A. Students would independently work through the patient case outside of class to formulate  
11 an assessment and plan for each of the patient's pain and symptom management problems. Students  
12 were assigned small groups to work with in class to review their individual findings and formulate a group  
13 assessment and plan for each problem to discuss with the class and instructor. Twenty-six students were  
14 divided into 6 groups of 4 to 5 students each. The class demographics are described in Table 2. Groups  
15 were assigned by the course coordinator to ensure a balance of second and third professional year  
16 students. The rationale was that the third year students would provide support with therapeutics  
17 knowledge and the clinical reasoning process to the second year students who were in their first  
18 semester of the pathophysiology and therapeutics sequence. No additional criteria were used to create  
19 the small groups. Since the students were not previously exposed to PBL within the pharmacy  
20 curriculum, a slight modification was made to the modified case-based method. The first 30-60 minutes  
21 of class utilized for a student driven content discussion prior to the case discussion. The instructor  
22 facilitated the large group content discussion to assure that the key therapeutic content was reviewed.  
23 The didactic topics included content recommended by the Strategic Planning Summit for the  
24 Advancement of Pain and Palliative Care Pharmacy curricular workgroup.<sup>6</sup> Course topics included pain  
25 and palliative care drug information, overview of hospice and palliative care services, pharmacist's role in  
26 hospice and palliative care, communicating with terminally ill patients and their caregivers, pain  
27 assessment and classification, opioids and opioid dose conversions, adjuvant pain medications,



1 gastrointestinal symptoms, dyspnea, pruritus, delirium, fatigue, myoclonus, terminal secretions,  
2 anorexia/cachexia, legal and ethical considerations in palliative care, and palliative sedation. The course  
3 coordinator created the all the patient cases. They were based on actual patients that she cared for at her  
4 clinical practice site and adapted them to incorporate the course topics. A benefit of this elective course  
5 is the ability to provide more in-depth pain management content (e.g. 8 hours during the elective versus 4  
6 lecture hours within the school's required pathophysiology and therapeutics sequence). Additionally pain  
7 management principles were re-enforced throughout the course within the weekly patient cases.  
8 Numerous symptom management topics such as palliative sedation, anorexia/cachexia, terminal  
9 secretions, refractory dyspnea, pruritus, and terminal delirium are only didactically taught within this  
10 elective offering. There was a decreased ability to cover all Pain and Palliative Care Pharmacy curricular  
11 workgroup's content recommendations due to the extensive number of suggested topics and decreased  
12 ability to review as much therapeutic content with problem based learning teaching methods versus  
13 lecture. Study approval was obtained from the SJFC institutional review board (IRB). Informed consent  
14 was obtained prior to voluntarily student enrollment in this study.

15         The example patient case in appendix A was the last individual case study that the students  
16 completed. It was assigned during week 13 of 15 so the only outstanding didactic topics were legal and  
17 ethical considerations in palliative care and palliative sedation. The case focused on constipation,  
18 dyspnea, and nausea management which required students to draw upon multiple topics they learned  
19 over the semester.

20         Students' course grades were based on both quantitative and qualitative measures including  
21 weekly pre-class case preparation (15% of grade), 3 individual case studies (60% of grade), and  
22 responses to 3 self reflection questions at the end of the course (25% of grade). To assess knowledge  
23 gained over the semester a 17 question free response pre and post course test was given during the first  
24 and last classes. The course coordinator decided to make the pre and post course test free response to  
25 challenge the students to consider that there may be multiple correct answers to most of the questions.

## 26 **Assessment of student learning**

1           The course learning objectives were mapped to specific assessment activities. The first learning  
2 objective was to explain the differences between hospice and palliative care and identify patient  
3 populations who may benefit from hospice or palliative care services. This was assessed during the  
4 second week of the course through the students' pre-class preparation and completion of 2 cases for in-  
5 class discussion comparing palliative care and hospice appropriateness for a pancreatic cancer patient  
6 and an older adult patient with an inoperable bowel obstruction. The principle of hospice and palliative  
7 care appropriateness was incorporated into the case discussions throughout the semester. One student  
8 commented in their self-reflection response that determining when a patient qualifies for hospice or  
9 palliative care services was one of the most meaningful skills they learned in the course.

10           The second learning objective was to discuss pharmacists' potential roles on pain and palliative  
11 care interdisciplinary teams and how they impact patient outcomes. This was a longitudinal learning  
12 objective across the course because the concept of the pharmacist being the interprofessional team's  
13 pharmacotherapy expert was incorporated into the drug information and pain and symptom management  
14 case discussions throughout the semester. Other topics integrated into the patient cases which highlight  
15 a pharmacist's role include identifying drug related problems such as medications without an indication,  
16 drug interactions, dose adjustments for end-organ dysfunction, appropriate medication monitoring  
17 parameters, medication counseling, and clinical situations where stopping maintenance and preventative  
18 medications is appropriate. The second self reflection question addressing course impact to future  
19 practice also links to this learning outcome because it requires future pharmacists to consider their  
20 potential role in a pain or palliative care patient's clinical management.

21           The third learning objective was to discuss pain assessment and common types of pain. It was  
22 the primary focus of the pre-class preparation and in-class patient case discussion during week four.  
23 Elements of pain assessment were included within the patient cases for the following topics opioids, non-  
24 opioid adjuvant pain medications, pruritus, imminent symptoms, and gastrointestinal (GI) symptoms, as  
25 well as in the first individual case study assignment.

26           Assessment for learning objectives 4 and 5 are closely related. Learning objective 4 addresses  
27 the pharmacotherapeutic profile of opioids and non-opioid adjuvant pain medications while objective 5

1 discusses conversions between different opioid medications and formulations. These points were the  
2 focus of the opioid and adjuvant pain medication pre-class preparation and in-class patient case  
3 discussion during weeks 5, 6, and 7. Opioids, opioid conversions, and adjuvant pain medications were  
4 also secondary patient problems for the pruritus, imminent symptoms, and GI symptoms cases.  
5 Individual cases 1 and 3 also included these principals. Numerous students commented in their self-  
6 reflections on improved familiarity with the role of opioids in pain management and opioid conversions  
7 after taking this course.

8           The final learning objective was to explain potential etiologies, assessment, monitoring, and  
9 pharmacological and non-pharmacological management of common non-pain symptoms in palliative care  
10 patients. Nausea/vomiting, constipation, hiccups, dyspnea, fatigue, pruritus, terminal secretions,  
11 myoclonus, and delirium were assessed within pre-class preparation and in-class patient case discussion  
12 during weeks 6 to 13. Symptoms discussed earlier in the semester were often included within the  
13 problem list for patient case discussions later in the course. Individual cases 2 and 3 assessed  
14 constipation, nausea, hiccups, and dyspnea.

15 There are 4 measures of student learning and course usefulness. The first measure is the results from a  
16 pre- and post-test related to course material. The second measure is the SOAP notes that students  
17 produced for each of the 3 individual cases. The third, and potentially most useful, measure is the  
18 collection of student self-reflections that occurred at the end of the course. The fourth measure is the  
19 student course evaluations.

20

## 21 **Results:**

### 22 **Pre-test and post-test results.**

23           Students completed a pre-test of course material at the beginning of the course, and were tested  
24 using the same questions at the end of the course. A t-test comparison of the pre- and post-tests yielded  
25 a significant difference between the pre- and post-test scores ( $p < 0.001$ ), with the mean score for the  
26 tests increasing from 9.6 (out of 20 points) on the pre-test to 14.1 on the post-test. Additional statistical

1 tests yield further insight into this gain. First, Pearson's correlation coefficient between the pre- and post-  
2 test was 0.45; this correlation indicates a tendency for all students, and not merely the 'good students', to  
3 increase their score from pre- to post-test. (If, for example, only high scores on the pre-test increased  
4 from pre- to post-test, the correlation coefficient would likely be much smaller.) Furthermore, the variance  
5 in scores decreased from 7.1 on the pre-test to 3.2 on the post-test; this also indicates that it was not  
6 merely the 'good students' who increased their score. (Again, if only high scores on the pre-test increased  
7 on the post test, the variance would have increased.)

8 A final measure of the student learning in the course is the normalized gain,  $\langle g \rangle$ .<sup>21</sup> The  
9 normalized gain is a measure of how much learning takes place in a course, normalized by the amount of  
10 learning that could take place. If  $n_{max}$ ,  $n_{post}$  and  $n_{pre}$  are the maximum, post-test and pre-test scores,  
11 respectively, on a test, then:

$$12 \quad \langle g \rangle = (n_{post} - n_{pre}) / (n_{max} - n_{pre})$$

13 It has been commonly found that traditional teaching methods typically produce  $\langle g \rangle$  from 0.1 to  
14 0.3, while more interactive teaching methods typically produce  $\langle g \rangle$  from 0.4 to 0.6. The case method  
15 used in this course, which was very interactive, produced a  $\langle g \rangle$  of 0.43.

### 16 **Analysis of student case responses.**

17 The SOAP notes for the 3 individual cases were analyzed for common trends, misconceptions,  
18 and the like. The first individual case primarily assessed students' pain management knowledge. The  
19 second case evaluated constipation, nausea, and hiccups. Constipation, nausea, dyspnea, and opioid  
20 calculations were also assessed in the third individual case which may be referred to in Appendix A. All  
21 individual cases incorporated assessment of dose adjustments for end-organ dysfunction, medications  
22 without an indication, and drug interactions. An analysis did not find any instances of common mistakes  
23 or misconceptions among the students. The average score for each case was slightly more than 80% (as  
24 determined by two pharmacy faculty readers). For each case, rarely was any particular mistake (eg. not  
25 recognizing that use of ondansetron and diltiazem increase constipation risk in the third case) made by  
26 more than 5 students. Given that there were approximately 20 different mistake categories marked for

1 each case, most student mistakes are rather idiosyncratic, and indicate neither ongoing misconceptions  
2 on the part of students nor a systemic problem with the course design.

### 3 **Student self-reflections.**

4 Students were provided 3 self reflections questions at the beginning of the course which included:

- 5 • What is the most meaningful thing you learned in this class? How might this impact your future  
6 clinical practice and life choices?
- 7 • What benefit do you feel this class may have on your future ability to care for pain and palliative  
8 care patients and why?
- 9 • Do you think the case-based format was an effective teaching method to learn pain and palliative  
10 care pharmacotherapy and why?

11 All responses were submitted at the end of the semester. The self-reflection responses were  
12 examined by the 2 authors, but inter-rater reliability was not examined due to the authors' differing  
13 background knowledge. Nevertheless, 4 themes were identified by both reviewers. The  
14 common subjects included patient/family goals of care, individualization of patient care and contrast to  
15 curative treatment, improved comfort with "grey therapeutic areas", and student identified advantages and  
16 disadvantages of problem-based learning.

17 Students noted the importance of patient and family centered care for setting goals of care. Most  
18 students indicated that they began to see how the experiences and goals of the patient were paramount  
19 in palliative care. Goals of care are not static, but require frequent modification as patients<sup>1</sup> experience a  
20 change in their clinical status. Patients and families play a central role in decision making. One student  
21 stated that she found it important to understand "what a patient might actually be going through" and  
22 another said that the "patient's priorities and goals" were the most important guide for treatment.  
23 Pharmacists need to consider an individual patient's values and goals of care when evaluating the risks  
24 versus benefits of starting a pain or symptom management medication. For example, two patients may  
25 have the same pain rating but one of the patients may value alertness more than pain relief so they can

1 better interact with their loved ones while another patient might prefer decreased pain but accept  
2 increased sedation from pain medications.

3 Individualization of patient care decisions including comfort care as a potential treatment option was  
4 also a comment theme. The importance of viewing patients as people, not isolated disease states or  
5 symptoms, and providing holistic patient care was noted. A student noted: "pain should be treated based  
6 on the patient's experience of their complaint" rather than according to a pre-determined schedule of  
7 drugs. For the first time many students realized that comfort care is a valid therapeutic option when  
8 curative treatment is not possible. The patient cases provided a new frame of reference because they did  
9 not focus on clinical cure which contrasted to other didactic courses. This more patient-centered  
10 approach was different from their usual experience in pharmacy school, and the struggles that this  
11 difference produced, also were noted by several students. Students referred to the "unconventional  
12 decision making" and that the approach was a "different way than the normal curative medicine." The  
13 patient's care shifted away from curing or stabilizing acute and chronic diseases by focusing on objective  
14 data like target blood pressure goals or therapeutic drug levels. Instead changes in a patient's symptom  
15 management and quality of life became the clinical focus. Adjustments in treatment based on patient  
16 prognosis were also new concepts. One student noted that they had not previously considered that it  
17 would be reasonable to stop lipid lowering medications in a patient with a life expectancy of days to  
18 weeks because decreased cardiovascular events are a long-term benefit of statin medications. Other  
19 students stated that the course "opened my eyes" to the difficulties in working with patients in these  
20 situations.

21 Many students noted improved ease with "grey therapeutic areas". Patient care has many variables,  
22 so there is not one "right" answer. The opened-ended nature of the patient cases challenged students'  
23 decision making to consider the possibility of numerous reasonable clinical plans that could be justified with  
24 appropriate patient monitoring. While recognizing that palliative care is less rigid in its approach to  
25 medication, some students referred to this being a "grey area". One student noted a growing ability to "be  
26 able to see the bigger picture" to address the needs of the patients when it is not possible to be as  
27 precise as usual. This grey area requires a more "problem solving" approach to medication and students

1 noted the ability to “feel confident that [they] can develop and support an evidence-based medication  
2 regimen.”

3 Overall students reported that they enjoyed PBL, but resistance was noted with this new learning  
4 style. Some students were frustrated with the shift of teacher driven instruction to self-directed learning.  
5 Many commented that they would have preferred a more formal lecture on the topic before working on  
6 the cases. They were unsure if the assessment and plan they developed were appropriate because they  
7 were challenged to independently learn information and did not have expert knowledge guidance from the  
8 instructor on the topic before class. Students reported that ultimately this experience made them a  
9 stronger clinician and resulted in greater opportunity to apply concepts and knowledge. They reported  
10 the patient cases were a more stimulating way to learn the material than lecture. They enjoyed that the  
11 cases were based on actual patients which increased the topic's clinical relevancy and provided the  
12 instructor the ability to discuss the patient's actual clinical outcome. While students “would have  
13 appreciated” more direction in starting their cases, and there was the usual resistance towards new  
14 pedagogy such as described by Wenning, in the end the students were overall positive in their comments  
15 regarding PBL.<sup>22</sup> Students noted things such as their ability to “pull from our knowledge bank” outside of  
16 class and the integration of their knowledge that took place as a result of the course. One student, who  
17 acknowledged a lot of resistance at the beginning, stated that “ultimately, I am probably a stronger  
18 student for having worked through the thought process...but I did find it challenging.”

19

## 20 **Discussion/Conclusions:**

21 The course's PBL format was successful in providing students an opportunity to deepen their  
22 critical thinking abilities, especially as applied to non-curative situations, helped the students to develop  
23 confidence in their ability to make clinical decisions, and learn the importance of communication as part of  
24 the process of pain and palliative care. Each of these outcomes is a benefit to pharmacists in general,  
25 and in particular to those who work in pain and palliative care.

26 The course's PBL format required students to develop their critical thinking abilities and be  
27 inquisitive to build upon their pre-existing clinical skills. Their ability to gather and assess subjective and  
28 objective data was cultivated. Reinforcement of key concepts such as opioid calculations through

1 repetition over the semester developed confidence in clinical decision making. Students reported in their  
2 self reflections that the class discussions were beneficial in developing their assessment and plan  
3 rationale through justifying their case based reasoning process to their group members and classmates.  
4 Class discussions also increased individual awareness of the multiple potential clinical solutions to each  
5 of the patient cases.

6         Listening to others within their groups elicited valuable input that often changed their initial  
7 individual assessment and plan and resembled collaboration that occurs when working within an  
8 interprofessional team. Use of SOAP notes for the individual cases required students to justify their  
9 reasoning process in writing and provided the opportunity for each student to receive detailed feedback  
10 from an instructor with clinical expertise and experience in pain and palliative care pharmacotherapy to  
11 determine if their assessment and plan was reasonable as well as fix incorrect assumptions. The goal for  
12 developing students' critical thinking and communication skills is to increase their confidence solving  
13 complex patient care problems in future clinical practice.

14         Additionally, PBL assisted with integration of clinical and basic science knowledge from other  
15 didactic courses. Student comments after the course showed that students recognized that the clinical  
16 reasoning processes they struggled with in the course were important in their future clinical practice.  
17 Emphasizing the importance of the clinical reasoning process and self-directed learning skills early in the  
18 second and third professional years builds a foundation for experiential training later in the curriculum  
19 where they are expected to be more independent and possess the motivation to self-direct their learning.  
20 Increased use of active learning in the classroom may help bridge the transition between classroom  
21 learning and experiential education especially with its increasing curricular role since introductory  
22 pharmacy practice experiences were initiated in the 2007 standards.

23         The modified case based method was perceived as a more beneficial for second and third year  
24 students taking the elective because less experienced learners may respond better to a more structured  
25 format than traditional PBL.<sup>23</sup> This method focuses learners on the most significant clinical features of the  
26 case and provides a more structured approach to clinical problem solving. Despite the increased  
27 structure of this course compared to traditional PBL, students reported feeling "out of their comfort zone"



1 on the self-reflections. They would have preferred to have content presented in a more structured format  
2 prior to working on their patient case assessments and plans.

3           Despite the benefits of the design of this course, students still reported, in their self-reflections,  
4 resistance to inquiry and constructivist teaching methods. These challenges are similar to those reported  
5 by Wenning.<sup>21</sup> Students may initially oppose these teaching methods if they perceive them as a threat to  
6 high grades, especially if they were previously successful with lecture-based teaching. They may  
7 become distressed over not “knowing the right answer” because they have to arrive at it on their own.  
8 Transitioning from the role of passive to active learners requires students to have communication skills,  
9 assume responsibility for their learning, and depend on other group members to successfully solve  
10 patient problems.<sup>24</sup> Because students were not familiar with PBL elsewhere in the curriculum this may  
11 have resulted in decreased enrollment from 26 students to 2 students for the Fall 2011 course. The  
12 decline may have resulted from previous pain and palliative care elective students’ feedback to their  
13 peers when selecting electives or increased course options. While anecdotal reports from previous  
14 elective students noted that the case-based format better prepared them for APPE, it is unclear if more  
15 students will recognize the value of self-directed learning or if pressure will develop to modify the course  
16 to conform to the more traditional lecture format the students are comfortable with.

17           Participation in a PBL pain and palliative care elective course improved students’ knowledge of  
18 pain and symptom management pharmacotherapy, clinical reasoning process, and self-directed learning  
19 skills. Four additional themes were noted by students in their self-reflections including patient/family  
20 goals of care, individualization of patient care and contrast to curative treatment, improved comfort with  
21 “grey therapeutic areas”, and advantages and disadvantages of problem-based learning. Additional  
22 studies are needed to assess the long term impact of the skills developed in this course on students’  
23 future clinical interactions with pain and palliative care patients and caregivers.

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