

2011

Learning Bridge Tool to Improve Student Learning, Preceptor Training, and Faculty Teamwork

Reza Karimi
Pacific University

Pauline Cawley
Pacific University

Cassandra Arendt
Pacific University

Follow this and additional works at: <http://commons.pacificu.edu/phrmfac>

 Part of the [Education Commons](#), and the [Pharmacy and Pharmaceutical Sciences Commons](#)

Recommended Citation

Karimi R, Cawley P, Arendt C. Learning Bridge Tool to Improve Student Learning, Preceptor Training, and Faculty Teamwork. *Am J Pharm Educ.* 2011;75: Article 46.

This Article is brought to you for free and open access by the School of Pharmacy at CommonKnowledge. It has been accepted for inclusion in Faculty Scholarship (PHRM) by an authorized administrator of CommonKnowledge. For more information, please contact CommonKnowledge@pacificu.edu.

Learning Bridge Tool to Improve Student Learning, Preceptor Training, and Faculty Teamwork

Abstract

Objectives. To implement a Learning Bridge tool to improve educational outcomes for pharmacy students as well as for preceptors and faculty members.

Design. Pharmacy faculty members collaborated to write 9 case-based assignments that first-year pharmacy (P1) students worked with preceptors to complete while at experiential sites.

Assessment. Students, faculty members, and preceptors were surveyed about their perceptions of the Learning Bridge process. As in our pilot study,¹ the Learning Bridge process promoted student learning. Additionally, the Learning Bridge assignments familiarized preceptors with the school's P1 curriculum and its content. Faculty teamwork also was increased through collaborating on the assignments.

Conclusions. The Learning Bridge assignments provided a compelling learning environment and benefited students, preceptors, and faculty members.

Disciplines

Education | Pharmacy and Pharmaceutical Sciences

Comments

Copyright © 2011 American Association of Colleges of Pharmacy

Rights

Terms of use for work posted in [CommonKnowledge](#).

INNOVATIONS IN TEACHING

Learning Bridge Tool to Improve Student Learning, Preceptor Training, and Faculty Teamwork

Reza Karimi, PhD, Pauline Cawley, PharmD, and Cassandra S. Arendt, PhD

Pacific University Oregon School of Pharmacy

Submitted September 27, 2010; accepted November 29, 2010; published April 11, 2011.

Objectives. To implement a Learning Bridge tool to improve educational outcomes for pharmacy students as well as for preceptors and faculty members.

Design. Pharmacy faculty members collaborated to write 9 case-based assignments that first-year pharmacy (P1) students worked with preceptors to complete while at experiential sites.

Assessment. Students, faculty members, and preceptors were surveyed about their perceptions of the Learning Bridge process. As in our pilot study,¹ the Learning Bridge process promoted student learning. Additionally, the Learning Bridge assignments familiarized preceptors with the school's P1 curriculum and its content. Faculty teamwork also was increased through collaborating on the assignments.

Conclusions. The Learning Bridge assignments provided a compelling learning environment and benefited students, preceptors, and faculty members.

Keywords: learning, preceptor training, faculty, introductory pharmacy practice experience

INTRODUCTION

Experiential education plays a significant role in pharmacy education and allows for practical application of principles covered in classroom courses. However, a significant amount of time elapses between the classroom learning and the experiential component and a potentially synergistic learning opportunity is lost. As an analogy, this is similar to teaching a student the theory behind baking a loaf of bread, but not providing the opportunity to bake a loaf of bread until a much later date, forgoing the chance to increase understanding of the theory through practical application. Therefore, an effective pharmacy curriculum should support and integrate, wherever possible, concurrent didactic learning and experiential application. True curricular integration requires faculty members, administration, and preceptors to collaborate proactively to provide an optimal learning environment for students.¹ Because the experiential and classroom curricula are delivered by 2 sets of educators (preceptors and faculty members), without a system/plan in place to integrate the content of classroom and experiential curriculums, students may not make the necessary connection between knowledge acquisition and knowledge application. Faculty members may be unaware of details regarding the

experiential activities students perform at introductory pharmacy practice experience (IPPE) or advanced pharmacy practice experience (APPE) sites. Similarly, preceptors may be unclear about the order in which curricular topics are presented to students. The more preceptors and faculty members know about what their students have learned and how, the better they can assist students in integrating their knowledge. Accreditation agencies for healthcare professional programs emphasize the important role that such integration plays in student learning.²⁻⁴ The Accreditation Council for Pharmacy Education (ACPE) Standards clearly emphasize the important roles that experiential and classroom curricular integration and preceptor training play in pharmacy education.⁵ Similarly, the American Association of Colleges of Pharmacy's (AACP) Center for the Advancement of Pharmaceutical Care (CAPE) supports the idea that both faculty members and colleges and schools of pharmacy need to refine their curricular outcomes to meet the evolving needs of pharmaceutical care.⁶

Pacific University School of Pharmacy is a learner-centered environment where the didactic and experiential curricula occur in parallel to promote a comprehensive and practice-oriented educational experience for students.¹ The curriculum is delivered within a 3-year program and emphasizes active learning, critical thinking, and teamwork. The first 2 years (P1 and P2) are comprised of a series of didactic and concurrent IPPE blocks. During the first IPPE in P1, students learn the responsibilities of pharmacists

Corresponding Author: Reza Karimi, Pacific University Oregon School of Pharmacy, 222 SE 8th Avenue, HPC-Ste 451, Hillsboro, OR 97123. Phone: 503-352-7276. Fax: 503-352-7270. E-mail: karimir@pacificu.edu

and the operation of a pharmacy. Students are assigned to a single preceptor and are at an experiential site for 8 hours every other week. To integrate the classroom and experiential curricula more purposefully, we pilot tested a "Learning Bridge" strategy in the fall 2008, with a series of 4 assignments generated by faculty members and completed by P1 students at their IPPE sites. After receiving positive feedback from this pilot study, we refined the Learning Bridge process, using only case-based assignments and providing preceptors with an answer key to improve their ability to guide students at the site.¹ We then assessed the hypothesis that the Learning Bridge process could improve the educational outcomes for all involved: not just students, but preceptors and faculty members as well. Simply put, by better informing preceptors and faculty members about what students were doing in the classroom and in experiential settings, we hoped that both groups of educators would be enabled to help students build a "bridge" between concepts learned in class and tasks performed in the pharmacy, and in the process, increase their own knowledge.

In our pilot study, we implemented 4 Learning Bridge assignments that were effective in bridging students' learning from the classroom with the practical experience they gained at their IPPE sites.¹ We generated 9 additional case-based Learning Bridge assignments that, similar to our pilot study, applied science concepts to patients, drugs, and disease states commonly encountered in a retail pharmacy setting (Appendix 1 and Appendix 2). Based on feedback received from students who completed the pilot study, the design of the assignments was altered to include patient cases.

DESIGN

The desired outcomes of this second study were to: (1) enhance student learning by bridging the IPPE with the classroom curriculum; (2) facilitate introduction of the P1 classroom curriculum to preceptors; (3) invigorate preceptors' knowledge of biomedical and pharmaceutical sciences; and (4) enhance teamwork among faculty members.

Before creating the Learning Bridge assignments, nonpharmacist faculty members consulted with pharmacist faculty members concerning "real world" details of the patient cases, appropriateness of the questions for a community pharmacy setting, and the feasibility of completing the assignment within the desired timeframe (1-2 hours) at the experiential site.¹ Students were required to complete each Learning Bridge assignment while at the community pharmacy site and to consult with their preceptor concerning the assignment for additional input and

learning. An answer key for each Learning Bridge assignment was provided to each preceptor via e-mail prior to each day of the IPPE, to facilitate preceptor involvement with the student concerning the assignment even if the science material was not familiar. Students submitted their responses to the faculty member who authored the assignment for review and grading via Blackboard (Blackboard Inc, Washington, DC). Finally, faculty members facilitated a 20-minute wrap-up session to P1 students in the classroom with the pharmacist faculty member present to close the "learning loop." These sessions provided general feedback about the assignment to students and facilitated discussion about responses to the questions.¹

EVALUATION AND ASSESSMENT

After a full year of implementation, the course instructor conducted a series of assessment activities to collect students', faculty members', and preceptors' input about the role the Learning Bridge process played in student learning (the survey instrument is available from the author). In addition, faculty members and preceptors were asked to reflect on the contribution, if any, of the Learning Bridge process to the dynamic of faculty teamwork and precepting success, respectively. The Blackboard tool was used to collect responses from students, and SurveyMonkey (SurveyMonkey, Portland, OR) was used to administer the preceptor and faculty surveys. Quantitative and qualitative questions were included in each survey instruments. Quantitative responses were based on the following Likert scale: strongly agree, agree, neutral, strongly disagree, and disagree. We considered a combined score of strongly agree and agree equal to or greater than 75% to be a desired and acceptable level of agreement. The Pacific University Institutional Research Board approved the study and the 3 survey instruments.

In addition to completing survey items about the benefits of the Learning Bridge assignments, all 3 groups were asked questions about student learning. Because student learning is difficult to assess objectively and student perceptions may not accurately assess the intended learning outcomes,⁷ we felt it was important to assess student learning from multiple viewpoints. The following definitions were included on the student survey instrument to ensure that we collected accurate student perceptions.

Critical-thinking skills: intellectual skills to critically interpret and evaluate a concept or a problem in order to synthesize or find an accurate answer to a question.

Self-directed learning: students are self-guided and know how to use their knowledge and resources to complete assignments.

Active learning: students utilize and refer to their own knowledge to answer a question and also actively seek and explore other resources and gather relevant information to improve or find a better answer.

The above definitions also were included on the preceptor survey instrument in the pilot study, but not on the faculty survey instrument because the definitions had been discussed frequently in faculty development workshops. Student, preceptor, and faculty responses to the quantitative survey questions assessing student learning outcomes are summarized in Table 1.

Completion of the student survey instrument was mandatory and therefore had a 100% response rate (n = 92). Submission of the preceptor survey was not mandatory, and 26 preceptors completed the survey (28% respondent rate). In addition, 12 faculty members familiar with the Learning Bridge process (7 pharmacist faculty members and 5 PhD nonpharmacist faculty members completed the faculty survey [71% response rate]).

Study Outcome 1: Enhancing Student Learning by Bridging the IPPE with the Didactic Curriculum

Eighty-two percent of students, 96% of preceptors, and 82% of faculty members believed that the Learning Bridge assignments facilitated student learning of both didactic and experiential materials (Table 1). Many qualitative comments from all 3 surveyed groups also supported this outcome (Tables 2 and 3).

Seventy-six percent of students, 92% of preceptors, and 64% of faculty members agreed that the Learning Bridge assignments promoted students’ self-directed learning skills (Table 1). The remaining 36% of the faculty members selected “do not know.”

The school’s curriculum emphasizes the use of active-learning components during the first 2 classroom lecture

years.^{1,8} Seventy-seven percent of students, 92% of preceptors, and 73% of faculty members agreed that the Learning Bridge assignments promoted students’ active-learning skills (Table 1). All faculty members who did not agree chose “do not know” rather than disagreeing with the statement.

Ninety-two percent of preceptors and 81% of students believed that the Learning Bridge assignments promoted student critical-thinking skills. A majority of faculty members (64%) agreed with the role the Learning Bridge process played in promoting critical-thinking skills (Table 1), while the rest were unable to answer.

Study Outcome 2: Facilitating Introduction of the P1 Didactic Curriculum to Preceptors

Eighty-nine percent of preceptors agreed that the Learning Bridge discussions with their student improved their awareness of the school’s first-year curriculum, and several mentioned this as a significant benefit of the Learning Bridge process (Table 3). We also explored whether the introduction of the curriculum afforded by the Learning Bridge process improved the preceptors’ ability to precept P1 students. Eighty-four percent of preceptors believed the Learning Bridge process improved their ability to precept P1 students as a direct result of the increased preceptor knowledge of the P1 curriculum. In addition, 69% of preceptors felt they were an active member of the school’s academic community as a result of the Learning Bridge process.

Study Outcome 3: Invigorating Preceptors’ Knowledge of Biomedical and Pharmaceutical Sciences

Eighty-eight percent of preceptors believed the Learning Bridge assignments invigorated their knowledge of

Table 1. Assessment of Student Learning From the Learning Bridge Assignments

Survey Questions	Responses, % (Combined Strongly Agree and Agree)		
	Students (N = 92)	Preceptors (N = 26)	Faculty Members (N = 12)
The Learning Bridge assignments increased students’ active learning skills	77	92	73 ^a
The Learning Bridge assignments increased students’ critical-thinking skills	81	92	64 ^a
The Learning Bridge assignments increased students’ self-directed learning skill	76	92	64 ^a
The Learning Bridge assignments facilitated student learning of the didactic and experiential materials	82	96	82
The didactic learning in the classroom made students confident to discuss the Learning Bridge assignments with their pharmacy team	93	92	100

^a 27%-36% of faculty members indicated that they did not know the answer to this survey question

Table 2. A Summary of Preceptors and Faculty Qualitative Comments About How the Learning Bridge Process Made a Difference in the Pharmacy Education of the Pharmacy Students

Preceptor Responses

It helps the preceptor focus on specific areas. The learning bridges help us teach the students things we may have long forgotten and it does bring student and preceptor together and opens up a dialogue.

Helps pharmacy preceptor and student to appreciate the complexities of the profession.

Helps the student learn how to use the pharmacy's resources, helps the student focus their learning and applying their knowledge with practicing retail pharmacists.

It helps me guide student learning to match what they are being taught in school and bridges the education gap between being a professional and being a student.

Gives topical information to discuss with student that may not otherwise come up in retail practice.

I was impressed in many ways at how the system allowed the students to integrate into the pharmacy setting.

Faculty Responses

The Learning Bridge helps students understand why they are learning some of the theoretical aspects of the early curriculum, provides an avenue for "real" pharmacy topic discussions and helps satisfy the students' desire for the curriculum to be practical and relevant to pharmacy.

It brings a practical aspect to their learning by integrating their experiential experience with their didactic experience.

It introduces and enforces the integration of basic science and practice application and increases the interaction between the preceptor and student on scientific topics.

I think it achieves its goal of demonstrating the clinical applicability of the foundational science class material.

Students make connection between theory and practice, they apply their didactic learning to pharmacy practice, increase interaction between preceptors and students, make the learning fun and effective.

It encouraged good interaction between students and their preceptors on topics that the students should have been knowledgeable about.

biomedical and pharmaceutical sciences. In addition, 82% of preceptors agreed that they learned something from the Learning Bridge assignments that they did not know before or had long forgotten.

Study Outcome 4: Enhancing Teamwork Among Faculty Members

One hundred percent of nonpharmacist faculty members and 86% of pharmacist faculty members agreed that effective teamwork among faculty members was a major benefit of the Learning Bridge process. In addition, all nonpharmacist faculty members (100%) stated that generation of their Learning Bridge assignment was a teamwork effort in which they consulted the pharmacist faculty members in order to produce an effective Learning Bridge assignment and that consultation with pharmacist faculty members improved their understanding of how to integrate classroom learning and experiential areas into Learning Bridge assignments.

Additional Study Outcome Benefits

88% of preceptors indicated that Learning Bridge assignments were effective at assessing learning strengths and weaknesses for their students, 100% of faculty members agreed that Learning Bridge assignments assessed and promoted student learning.

Ninety-three percent of students agreed that classroom lectures/content made them confident to discuss

the Learning Bridge assignments with their pharmacy team (Table 1). One hundred percent of faculty members also agreed with the above statement. Ninety-two percent of preceptors agreed that their students became more confident during their conversations as a result of having the Learning Bridge assignment to discuss. Benefits of the Learning Bridge to students, preceptors, and faculty as indicated by the results of the 3 surveys are summarized in Figure 1.

DISCUSSION

Pharmacy students must be able to interpret a question or problem, identify appropriate resources to research it, and evaluate the information in those resources in order to come to a solution. Thus, pharmacy students need to develop their active-learning, self-directed learning, and critical-thinking skills. The Learning Bridge provides a way to hone these essential learning skills while integrating learning materials and experiential training to provide a comprehensive educational experience. Data collected in this study provided compelling evidence of the effectiveness of the Learning Bridge process in overcoming some of the challenges to integration and the benefits that this process brought to students, faculty members, and preceptors as reflected in both quantitative and qualitative responses from all 3 groups. Perceived benefits of the Learning Bridge (Tables 2 and 3) included faculty teamwork, student

Table 3. A Summary of Students, Preceptors, and Faculty Comments about the Most Significant Value of the Learning Bridge Process

Student Responses
Applying principles that we learned in class to a practical setting at our sites.
Being able to discuss clinical issues with our preceptors.
Learning how to use package inserts as a good resource.
It helps make connections and “bridge gaps” in our learning process.
Preceptor Responses
That I always learned something new as well as had something to teach the students they didn’t already know.
It was a way to connect with the student and assess their strengths and weaknesses, which helped in precepting the student.
Getting to meet students and see what questions they’re being asked in class was very interesting.
It helped me understand the curriculum better and encouraged me to think about things from a student/learning point of view again.
Faculty Responses
The Learning Bridge gave us a focused opportunity to collaborate and learn from each other. I think the faculty learned as much as the students did!
Thought it was a neat idea to involve the preceptor and site with the assignment.
The Learning Bridge assignments help resolve the apparent disconnect between P1 didactic and experiential content and it shows the science faculty’s commitment to understanding what pharmacy students need to be successful in practice.
I loved it when students included in their answer to the assignment what they liked, or what their preceptor liked, about that particular assignment. Also, the fact that the answers were open-ended helped me to see which students really “ran with” the assignment.

learning, and preceptor learning of the curriculum, which were all goals of the Learning Bridge process, and the comments reflect all 4 components of Fink’s Taxonomy: incorporating foundational knowledge, application, integration, and caring.⁹ Figure 1 summarizes benefits that the Learning Bridge process brings to students, preceptors, and faculty members.

Study Outcome 1: Enhancing Student Learning by Bridging the IPPE with the Didactic Curriculum

With encouragement from the ACPE (Standard No. 11),⁵ many US colleges and schools of pharmacy are actively engaged in a learning process that assists students in

developing active-learning,^{1,8,10,11} critical-thinking,^{1,12,13} and self-directed learning skills.^{1,14} The results of the present study confirmed the results from the pilot study,¹ with a majority of students, preceptors, and faculty members agreeing that the Learning Bridge process promoted development of all 3 of these skills in participating students (Table 1). Furthermore, 71% of preceptors agreed that the Learning Bridge assignments were an effective tool they could use to assess how well their students were learning the practice of pharmacy, though the Learning Bridge is not intended to address all aspects of pharmacy practice.

Approximately 30% of faculty members and 5% of preceptors were not able to assess the Learning Bridge’s effect on student’s active-learning, critical-thinking, and self-directed learning skills. One explanation for the difference between faculty members’ and preceptor’s ability to assess these skills is that faculty members were not present at experiential sites to directly observe students’ engagement in completing the assignments. Additionally, while nonpharmacist faculty members (100%) and preceptors (96%) agreed with the statement that Learning Bridge assignments facilitated student learning of both didactic and experiential materials (Table 1), only 67% of pharmacist faculty members agreed, while the others chose “do not know.” This difference may have been because some of the pharmacist faculty members surveyed were not regularly involved in giving lectures to P1 students.

Due to different experiences, responsibilities, and tasks that preceptors and faculty members have at their respective work sites, a preceptor may experience student learning and progress differently than a faculty member. A comparison of faculty and preceptor views about the ways in which the Learning Bridge process made a difference in pharmacy education for students shows that these groups do have different viewpoints (Table 2). While faculty members commented primarily on the integration between classroom and experiential materials, preceptors also mentioned the opportunities for dialog that the Learning Bridge activities opened between them and their students.

Study Outcome 2: Facilitating Introduction of the P1 Didactic Curriculum to Preceptors

Many preceptors would agree that the more they know about a program’s curriculum the better they can assist the program’s students with their learning and progress. Since the biweekly Learning Bridge assignments were based on concurrent didactic materials, the text of the assignments and answer keys as well as discussions between preceptors and students could assist preceptors in identifying faculty members’ expectations and which

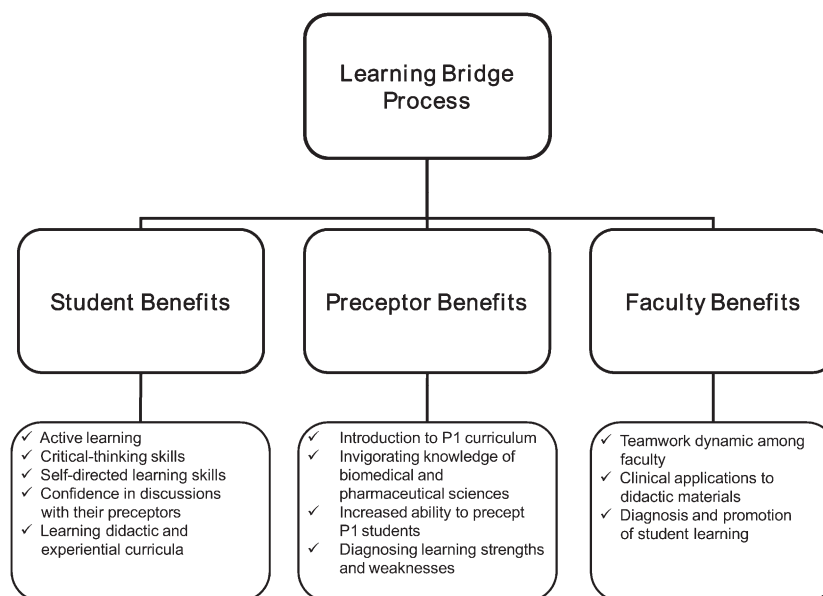


Figure 1. A Summary of Unique Benefits Conferred by the Learning Bridge Process on Students, Preceptors, and Faculty Members.

didactic curricular topics were delivered. In other words, the Learning Bridge assignments could paint a picture of what the P1 curriculum was about. In the busy pharmacy environment, preceptors are challenged to provide patient-centered care while facilitating student skill development with little time to develop educational materials for students. The Learning Bridge assignments provided clear learning goals and expectations for each experiential session and assisted the preceptor in providing a learning experience that was “in line” with the curriculum without having to spend preparation time that could potentially detract from patient care responsibilities. The majority of preceptors felt that the Learning Bridge positively benefited student learning and considered the integration of didactic and experiential education highly valuable. Preceptors felt better able to gauge the strengths of their students because they had a better understanding of educational expectations. In addition, a few preceptors suggested shorter assignments or more applicable assignments. A majority of preceptors felt that the Learning Bridge process integrated them into the school’s academic community. The latter result can be further improved by providing preceptor training and emphasizing the significant role preceptors play in student education by implementing the Learning Bridge process.

Study Outcome 3: Invigorating Preceptors’ Knowledge of Biomedical and Pharmaceutical Sciences

Because the foundational sciences that comprise the majority of the P1 curriculum at the school change over

time, with new topics such as pharmacogenetics entering the curriculum only recently, and were studied by most preceptors 5 or more years ago, interaction with the Learning Bridge assignments and answer keys could be expected to refresh or expand the knowledge of many preceptors. Our provision of answer keys to the Learning Bridge assignments provided preceptors with an opportunity to review pharmacy-related topics and therefore refresh or enhance their own learning. The majority of preceptors did take advantage of this opportunity and learned something from the Learning Bridge assignments that they did not know before or had long forgotten. In addition, some preceptors commented in their responses to qualitative questions that the assignments provided enhanced professional satisfaction from their increased ability to be an integral part of the student learning process due to increased understanding of the curriculum (Table 3) and from witnessing student confidence in discussions on the topics of the assignments. By ensuring that preceptors acquire knowledge about the pharmacy curriculum, the Learning Bridge process assists preceptors in enhancing their supervision and assessment of their students.

Study Outcome 4: Enhancing Faculty Teamwork

While many colleges and schools of pharmacy encourage their students to work in a team and/or assist them in teambuilding skill development, little emphasis is given to encouraging faculty members to work as a team, particularly across pharmacist and nonpharmacist lines. The 13 biweekly Learning Bridge assignments generated

over the course of an academic year were written by faculty members representing pharmaceutical science, pharmacy practice, and 2 social/administrative sciences. Faculty members were encouraged to work together to generate effective Learning Bridge assignments that integrated classroom and pharmacy concepts and practices and could be performed with the resources available at a retail pharmacy within the desired timeframe. As was mentioned earlier, 92% of faculty members agreed that one of the main keys in the success of the entire Learning Bridge process was effective teamwork among faculty members. The nonpharmacist faculty members unanimously stated that consultation with pharmacist faculty members improved their understanding of how to integrate didactic and experiential concepts and practices into Learning Bridge assignments. The generation of Learning Bridge assignments can be used at colleges and schools of pharmacy to encourage nonpharmacist faculty members, particularly from pharmaceutical sciences departments, to be familiar with what students learn at experiential sites, which may in turn encourage them to make their didactic materials more integrative to further enhance student learning.

Barriers and Improvements

Building a learning bridge was a manageable curricular task with significant benefits to student learning that outweighed the costs of faculty time required to implement it. However, we did encounter a few barriers to assessment and also implementation of the Learning Bridge. Despite multiple e-mail reminders to preceptors, our response rate to the preceptor survey was low (28%). Despite the low response rate, we believe the results are still valuable as they confirmed many of our observations from the pilot study.¹ However, the responses obtained may be skewed toward the preceptors with the most positive opinion of the Learning Bridge assignments, while those who were less enthusiastic may have been unmotivated to complete the survey instrument. The low response rate could be explained by limited access to the Internet, heavy patient-care workload, and/or preference for survey instruments in paper form. To address this barrier, we may use a paper form that does not require Internet access for future preceptor surveys. Also, there were 2 preceptors who consistently marked “disagree” across all survey questions, indicating that they did not like the Learning Bridge assignments. Seeking buy-in from preceptors, and not just faculty members and students, is important. Second, a few student Learning Bridge submissions were identical to the preceptor’s answer key. Therefore, it is important to clarify our expectations with both students and preceptors to ensure that adequate time is set aside

for the Learning Bridge activity at the experiential site. We also plan to ask students to cite their literature sources in their responses to discourage them from using the preceptor’s answer key. If the IPPE is split into community pharmacy sites and health system sites, generating a universal Learning Bridge assignment that is practical to implement at both types of sites will be challenging. To avoid this, 2 different assignments could be generated to meet desired student learning outcomes at both types of experiential sites. Finally, a few faculty members marked “do not know” in answer to a few quantitative questions; assessing the reasons behind those statements will be important.

The Learning Bridge process is now a formal component of our PharmD curriculum. Clinically relevant cases that are focused on pharmaceutical science content also can be used in other ways. For example, an independent study student on temporary leave from the school was assigned to write Learning Bridge-style case studies as a means to retain curricular knowledge. Preliminary data show that the student learned a significant amount by generating the cases. This result initiated a discussion among faculty members to allow P2 students, under faculty supervision, to generate Learning Bridge assignments for P1 students, thereby helping both groups of students in learning and retaining their science knowledge.

SUMMARY

Faculty members generated a series of pharmacy-related Learning Bridge assignments designed to be completed by students at a pharmacy site. The students’, preceptors’, and faculty members’ perceptions, combined with our observations, indicated that the Learning Bridge process played an instrumental role in promoting student learning and confidence in discussions with their preceptors, familiarized preceptors with our P1 curriculum, assisted them in invigorating their knowledge of the curricular topics, and increased their ability to precept P1 students, and increased the dynamic of faculty teamwork. The Learning Bridge process integrates classroom and experiential realms, and the results were sufficiently encouraging to incorporate the Learning Bridge process into P1 and P2 curricula.

ACKNOWLEDGMENTS

We sincerely thank Pacific University Oregon P1 preceptors and the class of 2011 who diligently participated in this study. In addition, we extend our heartfelt thanks to our colleagues Ms. Becky Shipman and Professors Joe Bonnarens, Amber Buhler, Fawzy Elbarbry, Jeff Fortner, Brad Fujisaki, John Harrelson, Mike Millard, Vedavalli Pokala, Sigrid Roberts, and Susan Stein who contributed to the success of the Learning Bridge process.

REFERENCES

1. Karimi R, Arendt CS, Cawley P, Buhler AV, Elbarbry F, Roberts SC. Learning Bridge: curricular integration of didactic and experiential education. *Am J Pharm Educ.* 2010;74(3):Article 48.
2. Liaison Committee on Medical Education (LCME). Guide to the institutional self-study for programs of medical education leading to the M.D. degree. <http://www.lcme.org/selfstudyguide0809.pdf> Accessed March 19, 2011.
3. The Accreditation Council for Occupational Therapy Education (ACOTE) of the American Occupational Therapy Association (AOTA). <http://www.aota.org/Educate/Accredit/StandardsReview/guide/DOCTORAL.aspx>. Accessed February 15, 2011.
4. Accreditation Council on Optometric Education. <http://www.aoa.org/documents/OD-Manual-01-2009.pdf> Accessed March 19, 2011.
5. Accreditation Council for Pharmacy Education. Accreditation standards and guidelines for the professional program in pharmacy leading to the doctor of pharmacy degree, 2007. <http://www.acpe-accredit.org/pdf/Finals2007Guidelines2.0.pdf> Accessed March 19, 2011.
6. American Association of Colleges of Pharmacy Center for Advancement of Pharmaceutical Education. Educational Outcomes, 2004; <http://www.aacp.org/resources/education/Documents/CAPE2004.pdf> Accessed March 19, 2011.
7. DiPiro JT. Student learning: perception versus reality. *Am J Pharm Educ.* 2010;74(4):Article 63.
8. Buhler AV, Karimi R. Peer-level patient presenters decrease pharmacy students' social distance from patients with schizophrenia and clinical depression. *Am J Pharm Educ.* 2008;72(5):Article 106.
9. Fink LD. *Creating Significant Learning Experiences. An Integrated Approach to Designing College Courses.* San Francisco, CA: Jossey-Bass; 2003.
10. Van Amburgh JA, Devlin JW, Kirwin JL, Qualters DM. A tool for measuring active learning in the classroom. *Am J Pharm Educ.* 2007;71(5):Article 85.
11. Brazeau GA. Reflections on active learning in the classroom: don't walk alone. *Am J Pharm Educ.* 2004;68(2):Article 52.
12. Austin Z, Gregory P, Chiu S. Use of reflection-in-action and self-assessment to promote critical thinking among pharmacy students. *Am J Pharm Educ.* 2008;72(3):Article 48.
13. Powers MF and Jones-Walker J. An interdisciplinary collaboration to improve critical thinking among pharmacy students. *Am J Pharm Educ.* 2005;69(4):Article 70.
14. Huynh D, Haines ST, Plaza CM, et al. The impact of advanced pharmacy practice experiences on students' readiness for self-directed learning. *Am J Pharm Educ.* 2009;73(4):Article 65.

Appendix 1. A sample of a Learning Bridge Case-Based Assignment. A typical student submission is shown here (*in italics*)

The role of pharmaceutics and physicochemical properties of active and inert ingredients in compounding a suppository to treat epilepsy

Amy Johnson is a newly registered pharmacist who has been working in a compounding pharmacy for one week. Today she received a physician prescription order to compound 20 diazepam suppositories (10 mg diazepam in each) for a 20-year-old man with epilepsy. Amy remembered from pharmacy school that making suppositories is a piece of cake because what she needed to do was to mix an appropriate amount of diazepam (valium) with a melted base and use a rubber or metal mold that could hold 2 g/suppository.

The prescription order is:

Rx: Diazepam suppository 10 mg

M. & ft. Suppositories #20 Base q.s.

Sig: insert one suppository rectally prn

Although Amy was good at using her compounding skills, she did not remember much about pharmaceutics. Therefore, Amy didn't know what suppository base she should use. However, she remembered that the following fat and water soluble bases are routinely used for formulating suppositories:

A. Cocoa Butter

B. MBK base

C. Fattibase

D. Polyethylene Glycol (PEG 1540)

Based on the physical nature and chemical structure of the drug substance, diazepam, your preceptor knows that only one of the above bases will work for the requested rectal dosage form. However, your preceptor wants *you* to help Amy. Please help Amy to survive her first week at the compounding pharmacy by answering the following questions and discussing your answers with your preceptor:

1. Find a package insert for diazepam and look at the chemical structure of the drug. Based on your knowledge of the structure of the drug you should be able to tell which of the above bases should be used to make the suppositories. Explain the connection between the structure of the drug and your selection for an appropriate base. Don't forget to attach the package insert (with your preceptor's initials on it), and highlight the area of the structure that helped you to select the right base.

Due to the presence of the ring structures and the amines found in diazepam, it appears that the drug will be primarily fat soluble. This led me to determine the PEG 1540 would be the appropriate choice of base for this drug. The other bases available are highly oleaginous and thus may "hold-on" too much to the diazepam, preventing it from entering the body. Diazepam should diffuse rapidly out of the PEG 1540 base because it is a water-soluble base.

2. She found diazepam 10 mg tablets and also diazepam Powder USP in the compounding pharmacy. Which of these two drugs should she prefer to use to make the suppositories? Why? Should she use water to make suppositories?

The diazepam Powder should be used. Crushing the tablets should be avoided because the tablet formulation will contain additional excipients that are not necessary for the suppository formulation. Water probably shouldn't be used because additional water may accelerate the degradation of the drug.

3. How much drug and how much base does Amy need to prepare for 20 suppositories? Each suppository as a finished dosage form should have a total weight as 2 g (including the drug).

The total weight of the suppositories should be 2000 mg and the weight of the drug should be 10 mg.

Therefore, 2190 mg of PEG base will be needed in addition to the 10 mg of drug in each suppository. 22 suppositories should be made in order to allow for extras. Therefore, 43.78 g of PEG base are needed and 0.22 g of diazepam are needed total.

4. What do the numbers 1540 mean in the front of PEG base and what does it have to do with its solubility?

1540 represents the average molecular weight of the PEG base. The lower the average molecular weight of the PEG, the more water-soluble the base tends to be.

5. Which of the above bases may cause rectal irritation? Why?

PEG is water soluble and so it will draw some water out of the rectal area as it dissolves, possibly causing some irritation. The cocoa butter base is the least irritating of the option out of the bases available. However, cocoa butter would not be suitable in this case.

6. Ask your preceptor how to counsel a patient on the proper technique for rectal administration of a rectal suppository. *It is important to make sure the patient understands that they must unwrap the suppository before insertion! Patients may lay on their side in order to aid with insertion and if possible, clenching will help hold the suppository in place initially. Parents may help children by holding their cheeks together post-insertion. Patients must be informed that many suppositories require refrigeration.*

Appendix 2. Description of delivered didactic topics, Learning Bridge study assignments, and their formats.

#	Didactic Topic	Learning Bridge Topic	Format
1	Molecular biology with Clinical Correlates	Antifungal medication and the role of antibiotics on protein synthetic machinery	Critical thinking/ application questions (applied to didactic topics 1-5)
2	Biochemistry: Metabolism with Clinical Correlates	Proton pump inhibitors and the effect of Ca^{2+} and Mg^{2+} on drug absorption	
3	Biochemistry: Metabolism with Clinical Correlates	Obesity, hyperlipidemia, and type II diabetes	
4	Biochemistry: Dietary Nutrition with Clinical Correlates	The importance of nutrition and vitamins and their impact on patient care	
5	Pharmacology and Medicinal Chemistry: Cardiovascular and Renal Systems	Pharmacological roles of ACE inhibitor and ARB drugs on patients with hypertension.	
6	Pharmacology and Medicinal Chemistry: GI and Skeletal Systems	Steroid anti inflammatory drugs and ulcer	Critical thinking/Case study (applied to didactic topic 6-13)
7	Pharmacology and Medicinal Chemistry: Endocrine Systems	Oral Contraceptives and their contraindications when used with migraine medications	
8	Hematology and Immunology with Clinical Correlates	Iron-deficiency anemia and blood count data analysis	
9	Pharmaceutics	The role of pharmaceutics and physicochemical properties of active and inert ingredients in compounding suppository to treat epilepsy	
10	Toxicology with Clinical Correlates	The effect of hypertension, dyslipidemia, angina, and diabetes on the chemotherapeutic treatment for patients with non Hodgkin's lymphoma	
11	Pharmacokinetics	The role of Pharmacokinetics on the therapeutic application for oral formulations of antiepileptic medications	
12	Pharmacogenomics	The role of Pharmacogenomics on the effect of warfarin and CYP450 enzymes	
13	Intro to Health Care Delivery System	Requirements, expectations, and responsibilities of Pharmacy in Charge (PIC) at a retail pharmacy	

Adapted from Karimi et al¹