A Newsletter for Undergraduate Problem-Based Learning from Samford University

PBL Insight

to solve, to learn, together

Vol. 3 No. 1

Inside

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PBL at Cornell University's College of Veterinary Medicine: Implications for Undergraduate Education

Kathleen M. Quinlan, Director, Office of Educational Development, College of Veterinary Medicine, Cornell University

In 1993, the College of Veterinary Medicine at Cornell University launched its new PBL curriculum. There are several key features of the academic program that may be applicable to undergraduate education. This paper presents a brief description of the program and some of its support structures, then draws out underlying principles from this example that can be adapted to other situations.

The Program

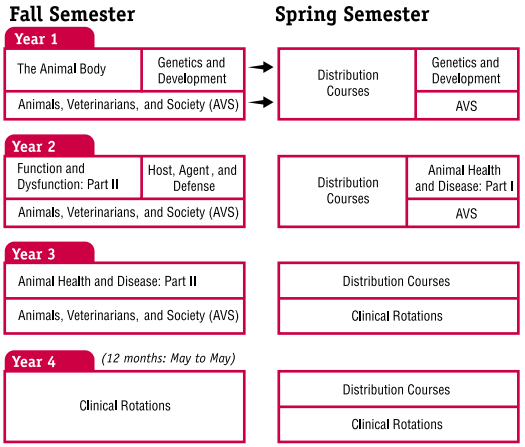
Curriculum development in the College of Veterinary Medicine was inspired by dissatisfaction with overcrowding in the curriculum, a recognition that the rapidly advancing body of knowledge in the field required new educational approaches, and the experiences of medical schools that had implemented similar reforms. These general forces for change are equally evident in many fields of study taught at the undergraduate level.

In a curriculum modeled after the New Pathway at Harvard Medical School, cohorts of 84 veterinary students progresses through four interdisciplinary, case-based foundation courses during their first three semesters of a four-year graduate, professional program:

Course I: The Animal Body (12 weeks)
Course II: Genetics and Development (8 weeks)
Course III: Function and Dysfunction (16 weeks, divided into parts A and B)
Course IV: Host, Agent and Defense (12 weeks)

Simultaneously, students are enrolled in Course VII: Animals, Veterinarians, and Society, a smaller course that runs in parallel with the major foundation courses and focuses on practical, social, and ethical aspects of preparation for professional practice. The topics that are addressed in Course VII are integrated carefully with the topics addressed in the associated foundation courses. In Course VIIA, for example, students learn and practice physical examination techniques that are matched to the body regions they are studying during Course I: The Animal Body. Figure 1 shows a schematic outline of the DVM program.

Figure 1: An Overview of Cornell's DVM Curriculum



The heart of the PBL curriculum lies in the collaborative tutorial process. Groups of six or seven students meet with a faculty tutor for two-hour sessions three times each week. During these sessions, students focus on practicing clinical reasoning and on deeply understanding the basic processes, mechanisms, and principles that underpin clinical medicine. In these sessions students set learning objectives for themselves (identify learning issues), share ideas and knowledge with their peers, justify their assertions, weigh competing explanations, integrate ideas from a variety of sources, clarify what they do not yet understand and evaluate their own learning process. The cases, written by faculty, are based on medical

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Editor's Notes:

Claire Major

Greetings Readers, and welcome to the first Year 2000 issue of issue of *PBL Insight!* We hope that this year will bring with it new experiences with and new information about Problem-Based Learning (PBL) in undergraduate education.

One of the issues that has attended the adoption of PBL in undergraduate education is use of a model that began in medical schools in the 1960s to this very different setting. Undergraduate institutions are quite different from professional schools in curricular design, funding, resources, etc. Yet undergraduate educators want the same things that prompted medical schools to implement PBL. We want to bridge the gap between theory and practice. We want to help students construct knowledge and integrate knowledge from different disciplines. We want students with critical thinking and problem-solving skills, team skills, communication skills, and a commitment and ability to pursue lifelong learning.

So, how do we adapt the medical model in an undergraduate setting? Each of the articles in this issue tackles that question by providing their school's and/or program's definition of PBL and by describing what this has meant in application of the method. Kathleen Quinland describes Cornell's program in veterinary medicine while specifically outlining what features of the program undergraduate institutions can use. Kevin Rudeen, Rich Oliver, and Michael Prewitt write about PBL in the school of Health Related Professions at the University of Missouri-Columbia and how they have incorporated PBL into a unique and interdisciplinary undergraduate allied health professions course. Karen Whelan and Marshall Jennings write about how they have used PBL in the School of Business here at Samford University, and they tell us how they have developed a typology of problems.

I hope that you enjoy this issue of *PBL Insight*—that you find it useful and informative. I welcome you to contribute articles or essays for future issues of *PBL Insight.* ▲

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PBL Insight

A Newsletter for Undergraduate Problem-Based Learning from Samford University

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Editor
Claire Major, Director, Center for Problem-Based Learning Research and Communications, Samford University

Managing Editor
Jack Brymer, Director of Communications, Samford University

Assistant Editor
Valerie McCombs, Research Associate, Samford University

Editorial Assistant
Janica York, Editorial Assistant, Samford University

Designer
Scott Camp, Multimedia Designer, Samford University

Invitation for Submissions:

The editor welcomes contributions to *PBL Insight.* The following are guidelines for those who would like to contribute work on Problem-Based Learning [PBL] in higher education.

Content

The editor welcomes both scholarly and research papers on PBL as well as reports of actual classroom practices.

Format

Scholarly papers, research papers, reports, essays, book reviews, news items, and letters to the editor are welcome. Please send both a hard copy and a disk copy of your article to the editor. Microsoft Word is preferred.

Length

Scholarly papers and research reports should be 1,000–2,000 words (four to eight typed, double-spaced pages). Book reviews, news items, or work documenting practices should be 100–500 words.

Style

APA style is preferred for documenting sources.

Deadlines

Future issues will be finalized one month before publication of the newsletter. Please send contributions for the next newsletter by April 1, 2000.

Please address all contributions to:
Claire Major, Editor
PBL Insight
800 Lakeshore Drive
Birmingham Alabama 35229

E-mail: pbl@samford.edu
Telephone: (205) 726-4097

Samford University
Birmingham, AL 35229

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Using PBL in Allied Health Science Courses

P. Kevin Rudeen, Ph.D., Associate Director
Rich Oliver, Ph.D., Director
Michael Prewitt, R.T., Ph.D., Chair
School of Health Related Professions, Office of the Director, and Department of Cardiopulmonary and Diagnostic Sciences,
University of Missouri-Columbia, Columbia, Missouri

Problem-Based Learning [PBL] was first introduced at the University of Missouri in the School of Medicine curriculum in 1993 and currently and successfully represents approximately 50 percent of the curricular time in the first two years of the four-year curriculum. The School of Health Related Professions [SHRP] has capitalized on these successes in adopting PBL methodology.

School of Health Related Professions [SHRP] and PBL

The SHRP supports the teaching, research, extension and services of professional programs under the following departments: Cardiopulmonary & Diagnostic Sciences, Communicative Science & Disorders, Occupational Therapy, and Physical Therapy.

The PBL used in the SHRP is based upon several founding principles. First, the PBL format should allow active, student-directed learning. We have applied this to mean that students will be allowed the freedom and opportunity to explore areas of their perceived weaknesses and interests, not necessarily areas prescribed solely by the faculty. Second, PBL focuses on contextual learning. This means that students should be provided cases in which problems are encountered, researched, and solved. Furthermore, in defining the problems from the student perspective, cases should relate to overall learning objectives. The case, in turn, should be written to provide student direction through inquiry, rather than through instruction. Third, use of PBL requires time for research and consolidation. PBL is an open-ended activity, which should allow students to define their learning issues and should provide students time to research, read, evaluate, and consolidate new information. Fourth, the success of PBL lies with the interest and cooperation of the faculty. The faculty role, as defined within our practice, is one of a facilitator rather than a tutor. Therefore, the role of the facilitator is not to impart knowledge but to act as a group manager, keeping the group on task and moving forward. The facilitators should stimulate group discussion by carefully weighed and timed questions and be sure that members of the group participate and are engaged intellectually in the group discussions. Fifth, regardless of the mode of education, we recognize that evaluation drives the student's learning process. This compels innovative evaluation and assessment instruments. When promoting learning in a variety of areas such as those associated with PBL activities, students should be rewarded for developing a broad knowledge base. Hence, the faculty associated with PBL activities should attempt to design assessment instruments that measure desired outcomes, including knowledge at expected depth, skills, and attitudes. Faculty should place importance on the PBL process so that the students know that their participation and contribution to the group are valuable activities that apply toward their evaluation. Timely formative and summative feedback also is important in helping the students reach the appropriate goals.

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PBL is an open-ended activity, which should allow students to define their learing issues.
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Respiratory Therapy Program and the Development of an Interdisciplinary Core

A part of the SHRP, the Department of Cardiopulmonary and Diagnostic Sciences at the University of Missouri respiratory therapy program was established in 1967 and is based on a strong liberal arts curriculum with a comprehensive science component. The professional program involves classroom and clinical course work that prepares students for private practice, including patient evaluation and management. Approximately 60 percent of the graduates from the program become employed in leadership positions in education or management.

The department consists of three disciplines of expertise, including respiratory therapy, nuclear medicine and radiography. Faculty within the department recognized the utility and advantage of providing contextual educational experiences and interdisciplinary learning for the development of the students participating in these programs. Key faculty within the department merged respective classes to form a single class, driven by PBL experiences, which focuses on clinical cases relevant to their professional disciplines. Members of the department have successfully adopted a PBL format, similar to that used in the School of Medicine, into coursework in the department.

Using PBL in a Health Related Professions Course

Certainly, PBL works best when students have the freedom to search in various disciplines so that they see how information in one discipline relates to information in another. An important tenet in using PBL in a Health Related Professions course was to provide students with a learning situation that would not restrict them to limited areas of exploration. While the course developed in our school was founded from three departmentally based areas, there was sufficient information to allow diversity in the case composition and to allow students freedom to explore beyond their own discipline. We followed several principles to successfully organize a departmental-based, allied health PBL class.

We used PBL for approximately 50 percent of the time allotted for the students' class contact time. This time allotment allowed sufficient emphasis on the PBL process to give it meaning to the students. Adequate time also allowed students to work in an active learning situation involving problem solving of an actual case. The remaining contact time was used for lecture and laboratory activities. Lectures, when given, complemented the case objectives but did not subvert the PBL discovery process. Lectures also were given

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Cornell University

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records from the College's teaching hospital. Cases are about 8–15 pages long and include laboratory data, slides, or radiographs from the patient. Students work through the case one page at a time, reading each section aloud. Students clarify all new terms, integrate new information into their hypotheses, anticipate next steps in diagnosis or treatment, and generate new learning issues before moving on to successive pages of the case. Cases are carefully paced to ensure that students reach particular points by the close of each session. Faculty tutors guide students' thinking and the group process during the tutorials.

In addition to the tutorials, students typically attend two structured laboratories and two or three lectures or interactive plenary sessions each week. Afternoons are reserved for students' independent study time. During that time, students work alone and in small groups, researching the learning issues they identified during tutorials. They may study recommended textbooks that are held in a special Core Resources section of the library, search a specially designed literature database for relevant journal articles, use hands-on resources in the Modular Resource Center, work through computer modules in the Wiswall Learning Lab, or consult with faculty experts.

Three key principles distinguish the PBL process: 1) students work collaboratively in small groups to critically analyze problems and to define learning issues; 2) students grapple with the problems before receiving instruction, rather than being taught material and then applying new concepts at the end of a unit; 3) faculty encourage students to take considerably more independence and responsibility for their own studies than in traditional curricula.

Basic features of PBL used at Cornell, such as problems as advance organizers for students' independent study, active collaborative learning among students, interdisciplinary integration, and faculty tutors, can be applied in a variety of situations. In addition, several of the design and support structures we use can be applied at the undergraduate level. Some discussion of those structures follows.

Course Design, Oversight, and Support

Each foundation course has its own Curriculum Design Group [CDG] made up of faculty from each of the specialty areas represented in the course. Each CDG is led by a course leader, a senior faculty member appointed to serve a three-year term. Administrative support and clinical expertise are offered by a course support specialist, often a clinician appointed for a two-year, non-tenure track faculty position. The members of the CDG jointly plan lectures, develop or revise cases and laboratories, review feedback about the course, and write and grade the exams. The CDG also recommends and approves distribution courses associated with their foundation course, of which students must take one or two courses from a number of choices. Most CDGs meet regularly for several months before the start of the course and during the course.

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The hardest aspect of PBL is to learn to trust yourself in the development of the learning issues, and deciding the appropriate depth and breadth to pursue.

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The CDG also contributes to the ongoing support of tutors for their new teaching roles. Tutors receive an extensive tutor guide for each case, which includes the objectives of the case, recommended pacing, guiding questions to pose to students, explanations of key concepts, clinical background, and a couple of suggested readings on the topic of the week. In addition to the written tutor guides, faculty tutors meet weekly to discuss issues that have arisen during the week, to clarify confusing points, to offer the CDG feedback, and to be briefed about the next case. During those briefings, the case authors or other experts present the case, go over the associated resources, such as radiographs or slides, and discuss the main points and common student difficulties with the cases.

A college-wide curriculum committee oversees the entire curriculum. The director of educational development serves on all curriculum design groups and is an ex officio member of the curriculum committee. The director also provides workshops for new tutors as well as continuing education opportunities about learning and teaching for the entire faculty. In addition, the director coordinates an orientation for new students to prepare them for PBL. Other staff members in the Office of Educational Development assist in the development of learning resources and provide administrative support to course leaders.

Student Assessment

Case-based assessments are designed to match the reasoning process expected of students during tutorials and to test students' understanding of the major course content objectives. Students work through several cases during two to three days of testing at the end of each foundation course. Like the cases studied during the course, the material is carefully sequenced. Students may receive one page in which the initial patient presentation is offered. Students may be asked to make some initial hypotheses, to prioritize the facts about the case, or to determine the most important questions to ask the owner. They turn in their answers before receiving the next page of the case. Each case may contain several sections. Students, abiding by an honor code, must complete the exam by themselves without consulting textbooks or other resources.

Program Evaluation and Continuous Improvement

Students have been valuable partners in the improvement process. Each foundation course has an extensive student course evaluation, which most students complete thoughtfully and thoroughly. In general, the new foundation courses have been rated positively by students. For many students, though, the transition to self-directed learning is difficult, which is evident in some of their evaluations. To quote from *The Inside Scoop,* a locally produced guidebook written by students, "The hardest aspect of PBL is to learn to trust yourself in the development of the learning issues, and most especially deciding for yourself the appropriate depth and breadth to pursue." Students often ask for more structure, more guidance, and more lectures in their course evaluations. Over several years, the faculty has made some concessions to provide students with more structure and guidance. For example, in some of the courses, the course objectives have been refined and elaborated in more detail to be more useful to students (and tutors) in guiding their learning throughout the course. The faculty also have provided more annotations about the textbooks and other learning resources

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that students may wish to consult during the course. In some courses, labs and lectures have been redesigned to ensure that they consistently support the cases. New interactive, large-group discussions in which a clinician and a basic scientist collaborate to review major principles in the context of different, related cases have also been added. Careful attention has been paid to ensure that the principles of PBL are adhered to even as incremental changes are made. These lessons may also be applicable to undergraduate education. There are ways to provide helpful structure and guidance for students that are in keeping with the philosophy of PBL. Creating those supporting structures and resources is one of the roles of a PBL educator.

To monitor the curriculum at a program level, the curriculum committee surveys graduating seniors and responds to student representatives' surveys of their classmates. The committee also has implemented a comprehensive program evaluation that includes an analysis of students' board exam results and surveys of faculty, graduates, and employers of the college's recent graduates. All of the surveys ask respondents to rate, on the basis of contact with students or graduates, the program's success at meeting its core educational goals, as well as to offer detailed feedback on particular knowledge, skills, and attitudes displayed by students or graduates.

Feedback from faculty indicates that most PBL tutors enjoy the small-group interactions with students and benefit from interacting with colleagues outside of their immediate research areas. Research productivity, as measured by grants won by faculty, actually has increased in comparison with other veterinary colleges since 1991, when the curricular initiative began. The annual curricular expenses are about the same as they were with the previous traditional curriculum.

Faculty Roles

The curricular restructure at the Cornell College of Veterinary Medicine places many faculty in the role of designers of educational experiences and facilitators of students' learning rather than lecturers. Changing roles have been accompanied by a shift in focus from teaching to learning. These changes in roles and perspectives are a critical feature of PBL that are equally applicable to undergraduate education, graduate education, grassroots or program-wide implementation. Academics in a variety of circumstances can examine their objectives and select and design problems or scenarios that will prompt and motivate students toward areas of study that will address those objectives. In the Cornell DVM program, a single case focuses a full-time week of study. Depending upon the context, though, a problem or scenario could be used to frame a larger or smaller unit of study. Instructors with small classes also can shift their roles from lecturers to facilitators of learning, promoting students' collaborative problem solving. Faculty with responsibilities for large classes could consider helping students learn to facilitate small groups.

Not only do faculty members' roles in relation to students change, but their relationship with their subject matter–even their definition of the subject matter–may also transform.

Nature of Knowledge

Not only do faculty members' roles in relation to students change, but their relationship with their subject matter—even their definition of the subject matter—may also transform. Medical problems—like other complex, real-world problems—require the integration of various disciplines to solve. Thus, restructuring Cornell's veterinary curriculum has involved rethinking the organization of knowledge in the field and making new connections between previously isolated disciplines and specialty areas. Scholarly collaboration among faculty in the college (within curriculum design groups and in tutor meetings) has been essential to this integration across different domains. Collaboration among faculty at the undergraduate level also can be a powerful vehicle for creating richer and more integrated PBL courses or programs of study. Collaboration not only enhances the curriculum, but also has the potential to advance various forms of scholarship in the field by promoting faculty learning, just as student collaboration around problems enhances their learning.

Conclusion

Cornell's College of Veterinary Medicine is an example of a program-level curricular change that has involved an entire college. This widespread, shared commitment to PBL has been critical to the success of the program. Important resources have been allocated to support the program, new governing bodies have emerged, structural changes such as class scheduling have been made and a shared understanding of the rationale and process of PBL has developed among students and faculty. Departments or colleges that are contemplating a full-scale program will learn most readily from aspects of the program design and support structure described above.

More information about the academic program at Cornell University's College of Veterinary Medicine can be found at: http://www.vet.cornell.edu/about/curric.htm. ▲

If you are currently using Problem Based Learning [PBL] in your undergraduate courses, or if you know of someone at your institution who is using PBL in undergraduate education, please contact us. We are very interested in learning about your efforts and about PBL at your institution.

Please contact Valerie McCombs via E-mail (pbl@samford.edu) or regular mail at the following address:

Valerie McCombs, Assistant Editor
PBL Insight, Center for Problem-Based Learning Research and Communications
Samford University
800 Lakeshore Drive
Birmingham, AL 35229

Allied Health

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as opportunities to introduce information into laboratory methodologies. Laboratories for allied health training were used to develop skills associated with the students' discipline and were planned carefully to coordinate with possible techniques used in the PBL case.

We used diversity of knowledge and experience to benefit student groups. Students in the SHRP department were a mixture of junior- and senior-level students. Coming from diverse knowledge-based backgrounds and association with different professional interests was regarded as an asset to each student PBL group. Students were divided into groups of no more than eight students and were mixed randomly into groups so that students from each subdiscipline were equally represented.

We used cases written from real patient problems. Our experience indicates that using real patient problems is the best way to develop a case. In developing a case, the case author has access to laboratory tests and data, including blood work, X-rays, MRI scans, or whatever tests and treatments were used in diagnosis, management, and/or rehabilitation. Copies of the actual tests (protecting the patient's confidentiality) were valuable tools, which allowed students to learn to use and interpret the tests appropriately.

When covering different informational disciplines in the course, we attempted to organize the PBL experience so that several cases were used and so that each of the cases focused on one of the subspecialty areas covered in the course. Cases were developed so that each case was used for approximately 4–5 weeks of the class and focused on one of the subdisciplines. The cases used in our example were general in nature to allow students to define learning issues critical to their learning needs, not only in their own disciplines, but also from the disciplines related to their subspecialty.

Finally, the patient was invited to attend a wrap-up session with all of the students present, which allowed the students to interact with the patient in a classroom setting. At the completion of each case, wrap-up sessions provided an opportunity for students to meet in a single group and ask questions of a faculty member proficient in the area of the case.

Discoveries Made and Lessons Learned

Working within university-dictated class schedules is one of the most significant challenges to developing a PBL based course. In an undergraduate allied health curriculum, most students are simultaneously completing requirements for the degree and are participating in their professional program. This means that the allotted time available for PBL activities may be restricted, and consideration for the case design must be taken into account. In addition to the PBL portion of the course, other course objectives may include laboratory experiences respective to each student's subdiscipline. Appropriate credit hours and class times may allow sufficient PBL contact time in a weekly two-hour session. Using this format, we found that students defined learning issues in each week's PBL session, researched the learning issues outside of the PBL session, and reported back to their group at their next meeting.

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Students reported feeling that the openness of PBL problems allowed them to think more openly, and be more prepared for solving problems in their clinics.

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We recommend that carefully defined, faculty-generated objectives be reviewed at the end of each case. These should reflect the major objectives the faculty believe the students should have derived from the case. The objectives also help ensure continuity among the groups of students and completeness of their own learning issues generated through the intervening weeks. Furthermore, they provide the students with objectives that will be evaluated. The objectives must be planned carefully so they do not corrupt the discovery process that should occur in the PBL sessions.

Formative and summative evaluation should occur periodically and in a timely manner to provide the students with feedback on how they are doing. We have found that oral evaluation after a few PBL sessions works well to change ongoing behaviors. This may be in the form of peer as well as facilitator evaluation, and it may be as informal as letting the students know what they are doing well and what they could improve. Ongoing evaluation of the resources students use is an important issue. Their ability to find and evaluate the validity of different resources should be promoted. More formal formative evaluation as well as summative evaluation may occur at the completion of each case. An evaluation mechanism can be developed whereby students can be responsible for information researched from their learning issues as well as the objectives provided at the end of the case. Examinations can be written, but use various formats such as multiple choice questions, preferably couched in vignettes. Question composition should take careful consideration to provide questions that offer students the opportunity to synthesize and integrate their knowledge, rather than stimulate responses from rote memory. Students also can be evaluated on their laboratory knowledge, skills, and behaviors through laboratory examination and faculty evaluation. Formative evaluation can take the form of individual feedback to each student in the respective group at the end of each case and exam period. This may be used as a portion of the student's overall course grade. Students should receive feedback relating to their performance on each of the PBL units as each case is completed. Finally, summative evaluation of the class can be provided in the form of scores and class grades representing a composite of each student's performance on all evaluative instruments, of which one such component should reflect their PBL participation as evidenced by their facilitator's evaluation using prescribed outcomes. Forms should be developed for faculty to help keep each group's outcomes somewhat similar.

As indicated above, faculty members assume the role of facilitators within groups, offering direction to the group and stimulating thought and discussion, but they do not instruct or tutor the sessions. Activities, discussions and learning issues are student-directed. Faculty assume responsibility for keeping the students on task while monitoring time and evaluating student interaction for formative feedback.

Interdisciplinary groups

Regardless of the course , students in each PBL group will have a wide range of life experiences and knowledge. This diversity is a strength and is capitalized on

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Undergraduate Business Education and Problem–Based Learning

Karen S. Whelan-Berry, Assistant Professor & Jennings B. Marshall, Professor,
School of Business, Samford University

Organizations in all sectors need employees with strong general business knowledge and acumen who can analyze enigmatic situations and solve complex problems, communicate related solutions effectively, and work well with others to successfully implement solutions. Many business schools, including the School of Business at Samford, have used case-based learning, games, simulations and experiential exercises to develop these skills in students. The Samford PBL Initiative provided the School of Business an opportunity to explore how to most effectively develop general business knowledge and acumen and to strengthen these particular skills in our students. We wanted to determine whether Problem-Based Learning [PBL] added to our students' learning and to their skills and abilities. In this paper, we briefly describe the experiences of the School of Business. We also present our definition of PBL, and we offer our initial typing of PBL problems, based on problem size. (Size refers to the amount of course content and the course time required for students to solve the problem.) In addition, we comment on the benefits and challenges of each type of problem, and we discuss the impact of PBL in our school as well as our plans to continue using this method.

School of Business Involvement in the PBL Initiative

The School of Business initially agreed to incorporate PBL in two existing courses in our curriculum through the Pew Charitable Trust Grant: Statistics I and Statistics II. Over the last two years, however, PBL has been implemented in six courses. Table 1 delineates the courses developed, the year students take the course, the faculty contact, and a brief discussion of the PBL approach used in the course.

PBL in the School of Business

Many researchers have already defined PBL and PBL problems, and we build on their work (Anderson and Sosniak, 1994; Barrows, 1996; Vernon and Blake 1993; Vilkinas and Cartan 1990; and Wilkerson and Gijselaers, 1996). We define PBL as having three core characteristics: 1) students confront ill-structured, real-world problems; 2) students work in small (ideally four-person) teams; and 3) students must seek and discern relevant course content, related information or data to be able to solve the problem. For the School of Business, ill-structured means that problems 1) are typically open-ended and could be solved in multiple ways or have multiple solutions; 2) do not include or identify all course content and or data required to solve the problem; and 3) are not obviously related to specific course content.

Initial Typing of Problems

In several of our business classes, multiple problems were based on the same organization and/or data set, allowing general demographic and background information to be offered once. This provides some efficiencies in terms of faculty time to develop data for problems; for example, we created a human resources employee database (that included employee satisfaction data) for the company in our problems. This data could then be used in problems in statistics and organizational behavior. All of our PBL problems involved four-person student teams, which the faculty member typically randomly assigned for the semester. These teams often rotated specified roles on a weekly or problem basis to ensure students participated and contributed equally. As we worked to implement PBL in the School of Business curriculum, we identified three sizes of PBL problems: topic-specific, unit, and field/term.

Topic-Specific PBL Problems

Topic-specific PBL problems typically cover a single theory or concept, can be worked in less than one class period, and can be solved through materials provided with the problem or through materials in the text. Student teams often do not have a formal deliverable. The problem may be debriefed in class and/or student teams offer notes or solutions documented in class.

Consider the following topic-specific problems from Statistics I and Investments.

Statistics I: "Two of your best employees resign within two days of each other. Is this just bad luck?"

Investments: "Your client, Clovis, is worried about investing in the stock market. You tell him that for long-term investors, the stock market has proven to be profitable. He asks you to demonstrate this."

Topic-specific problems do not take significant time and can ground a single major topic. A key benefit is that they allow students to work through the PBL process in a single class, proving the opportunity for the instructor, if necessary, to assist students in strengthening their skills. Often topic-specific problems feel time-consuming initially, and professors are tempted to think, "Shouldn't I just lecture?" Our data show that topic-specific problems often ground content for students in ways that other learning strategies do not and provide an opportunity for individual students and student teams to develop problem-solving skills. Students can see the problem-solving process more clearly in a topic-specific problem.

Unit PBL Problems

Unit problems cover and integrate a unit of material, involving multiple theories and/or concepts. Generally covering three to five chapters, in most cases unit problems last for two or more weeks and provide a means of summarizing and applying the material in a unit. Unit problems require time and materials not available in class, and students have a more formal deliverable, such as a team presentation or a written deliverable. Often faculty assign these problems in one class, and student teams offer their solutions and submit their deliverable several class periods later.

Consider the following unit problems: Organizational Behavior (OB), Marketing and Statistics II, respectively.

Organizational Behavior: "You recently were promoted to compensation coordinator for ALCORP. Human Resources recently updated the information they prepare annually, and the historical trend continues: women and minorities continue to earn less than white men do across ALCORP's locations and subsidiaries. The discrepancy in earnings is approximately 20 percent for white women, 22 percent for minority males, and 32 percent for minority females. Although all supervisors and managers have this information, the trend remains the same.

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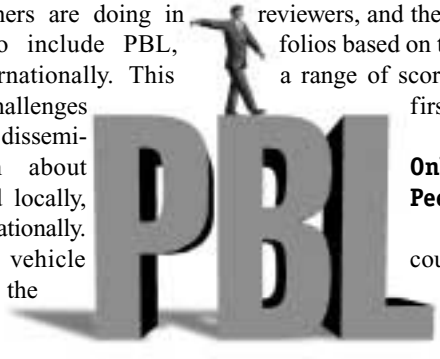
The Samford PBL Initiative Update

During the past two academic years, we have made considerable progress in our on-campus efforts to integrate Problem-Based Learning (PBL) across the Samford curriculum. We also have learned a great deal about what others are doing in their institutions to include PBL, nationally and internationally. This year we face the challenges and the promises of disseminating information about what we have found locally, nationally, and internationally. One dissemination vehicle we have adopted is the course portfolio.



Course Portfolios

In the last issue of *PBL Insight,* we told you about our efforts with course portfolios. Faculty taught courses in the both the fall of the 1998/1999 and the fall of the 1999/2000 academic years, and developed course portfolios out of these courses. These portfolios included a thesis statement (or reason that faculty wanted to use PBL), a discipline-specific review of the PBL literature, a problem explication, an analysis of course results, and a reflective piece. You may view our faculty-developed outline on our Web page at the following URL: www.samford.edu/pbl/aboutsu3.html#Course Portfolios. We believe that these portfolios represent the scholarship of teaching.

External Peer Review

Many faculty members requested that their portfolios go through external peer review. We devised lists of nationally recognized teachers in specific disciplines and nationally recognized teaching specialists. Project staff and faculty representatives developed rating sheets that asked the reviewers to rate portfolios based on a list of criteria adapted from Glassick, Huber, & Maeroff, (1997). *Scholarship Assessed: Evaluation of the Professoriate.* Jossey-Bass. These criteria included the following:

1. Adequate Preparation
2. Clear Goals
3. Appropriate Methods
4. Significant Results
5. Reflective Critique
6. Effective Presentation
7. Adequate Content
8. Clear Evidence of PBL
9. Appropriate form

In addition, rating sheets asked reviewers to state whether the portfolio was ready for publication, needed minor revisions, needed major revisions, or should not be published. Each portfolio went to two reviewers, and the reviewers rated the portfolios based on the above criteria. We had a range of scores; overall, we view this first effort as a success.

Online Publication of Peer-Reviewed Portfolios

We believe that these course portfolios demonstrate the scholarship involved in PBL instruction. Because of this, we also believe that they can and should be published as scholarly work. We are starting an online, peer-reviewed course portfolio registry for publishing portfolios that met standards of excellence in the review process. The first course portfolios will be published this fall.

Samford University Announces a New Project: Peer Review of Problem-Based Learning Courses

Samford has just been awarded a major grant from The Pew Charitable Trusts to continue and to expand our early efforts with PBL course portfolios. The purpose of the grant is to establish a network for the documentation and peer evaluation of the teaching of PBL courses. In order to accomplish this goal, we will offer mini-grants for faculty, national and international, to develop PBL course portfolios that will be peer-reviewed and potentially, if meeting standards of excellence, published on the online registry. See page 12 of this issue for details! ▲

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Allied Health

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in the group. PBL begins to break down when the subject matter and diversity is restricted too far. Classes work better when there is room for diversity. Hence, departments that can offer interdisciplinary classes with other departments will work well and enhance the student's experience in PBL. Likewise, classes within one department that offer diversity among different but related subject matters are opportunities to use PBL successfully.

Student Evaluation

Student evaluation of the use of PBL in a departmental setting is a valuable asset to refinement and improvement, just as with any other class. Administering questionnaires at the completion of the class will provide useful information on tutors, exams, class content, and other exercises. The value of PBL in the course can be evaluated in the form of questions regarding how the students may or may not feel prepared for the clinical experiences they will be facing. In our experience, students have reported feeling that the openness of the PBL clinical problems allowed them to think more openly, and therefore, be more prepared for solving problems in their clinics. Additionally, they have reported that they will not always rely on their textual materials or notes taken during class for obtaining knowledge, but that they are more apt to seek up-to-date information from reliable resources in a timely manner. We believe this better prepares them to become lifelong learners and better practitioners of their health specialty. Certainly, we have experienced the personal excitement of seeing students become enthusiastic and alive in their learning process, knowing that they will be better prepared to meet the demands and problems they may encounter in their future! ▲

PBL Insight Online

Download the newsletter from our Web site

http://www.samford.edu/pbl/

Resource Roundup

Call for Papers:

Journal On Excellence In College Teaching—Special PBL Issue

The *Journal On Excellence In College Teaching* will publish a special double issue on Problem-Based Learning in Higher Education in October 2001. Manuscripts will be due on February 1, 2001. Watch the next issue of *PBL Insight* for further details.

The *Journal* provides a written forum for discussion by faculty about all areas affecting teaching and learning and gives faculty the opportunity to share proven, innovative pedagogies and thoughtful, inspirational insights about teaching.

The *Journal* is published by and for faculty at universities and two- and four-year colleges to increase student learning through effective teaching, interest in and enthusiasm for the profession of teaching, and communication among faculty about their classroom experiences.

Accepted for publication are manuscripts on college or university teaching that demonstrate excellence in at least one of the following categories:

- *Research:* Reports important results from own experience or research; describes problem clearly; provides baseline data; explains what researcher has done and why; and provides results.
- *Integration:* Integrates research of others in meaningful way; compares or contrasts theories; critiques results; and/or provides context for future exploration.
- *Innovation:* Proposes innovation of theory, approach or process of teaching; provides original and creative ideas based on results of research by self or others; and outlines proposed strategy for testing effectiveness of ideas.
- *Inspiration:* Provides inspiration for teaching excellence; combines personal values, insight, and experience to communicate enthusiasm and dedication to outstanding teaching.

Articles appearing in the *Journal* may be interdisciplinary or specific to one or a group of disciplines and may address a general or specific audience.

For information on how to submit a manuscript, please contact:
Gregg Wentzell, Managing Editor
Journal On Excellence In College Teaching
Office for the Advancement of Scholarship and Teaching
Miami University
Oxford, OH 45056
(513) 529-7224 • wentzegw@muohio.edu

For more information about the journal, including information about how to subscribe, visit the *Journal* Web site at the following URL: http://www.lib.muohio.edu/ject/

Educating Knowledge Workers for Corporate Leadership:

7th Annual EDINEB International Conference
June 21–23, 2000
Newport Beach Marriott Hotel, Newport Beach, California, U.S.

The EDINEB-Network provides faculty support and development related to innovative education such as Problem-Based Learning [PBL]. The 2000 International Conference of EDINEB offers an opportunity to collaborate and network with people from the academic world, corporate training centers, and consulting firms. The central focus on the conference theme is highlighted from different perspectives of professional training centers, business organizations, and business schools.

For more information on submitting an abstract visit the Web site at the following URL: http://www.unimaas.nl/~edineb or E-mail EDINEB@FACBURFDEW.UNIMAAS.NL

Second International Interfaculty Conference on Problem-Based Learning [PBL] in Higher Education

September 17–20, 2000
Linköping, Sweden

The conference themes comprise contemporary development of Problem-Based Learning [PBL], outcomes of PBL programs, identity of student-centered education and trends for the future. Keynote speakers are Henk Schmidt (Maastricht), Annette Kolmos (Aalborg), Erik de Graaff (Delft), Kirsten Lycke (Oslo), Michael Field (Sydney) and Don Margetson (Brisbane). In addition, there will be a range of meetings such as paper sessions, workshops, roundtable discussions and poster sessions. Several students also will participate and will act in different roles such as chairpersons and discussants.

Conference information located at the following Web site:
http://www.ida.liu.se/conferences/PBL2000/

CONTEXT

CONTEXT is a National Center and Network for promoting the use of case materials and simulations in higher education and employment. Funded by The Partnership Trust and and coordinated by The University of Leeds with the Careers Research Advisory Center, CONTEXT promotes the use of case materials in higher education and employment. Currently, the center accepts materials related to Problem-Based Learning [PBL] and has included a PBL summary from Samford's Regional Geography course in their database. To learn more about CONTEXT, or to add a case study to their on-line database, visit their Web site at the following URL: http://context.tlsu.leeds.ac.uk/index.asp

Problem-Based Learning [PBL] in Nutrition

Barbara Lohse Knous, University of Wisconsin-Stout, produced a video concerning Problem-Based Learning [PBL] in general and how to use PBL to teach nutrition topics. The video, funded by the Allen Foundation, also contains a 48-page booklet with two problems, learning issues, course management tools and a resource list. For more information, contact Barbara at the following E-mail address: KnousB@m1.uwstout.edu or call (715) 232-1994.

The Journal of Clinical Problem-Based Learning

All health science educators using Problem-Based Learning [PBL] in their curricula are invited to submit cases, manuscripts and letters to the editor to be considered for publication in *The Journal of Clinical Problem-Based Learning* (www.JClinPBL.org). This freely accessible, peer-reviewed electronic publication is dedicated to furthering the development and application of PBL and other active-learning strategies in all health sciences.

Access to the journal is free but requires a simple validation of academic or professional credentials. All case authors retain legal rights to use published cases in their own institutions. Subscription fees apply only when outside institutions seek to use published cases as part of their curricula. Please direct all inquiries to the addresses below:

David S. Ziska, PharmD
Editor-in-Chief
The Journal of Clinical Problem-Based Learning
dziska@pharmacy.umsmed.edu

or

The University of Mississippi Medical Center
Department of Clinical Pharmacy Practice
JClinPBL editorial offices
2500 N. State Street
Jackson, MS 39216-4505
Phone (601) 984-2640, Fax (601) 984-2618

Business Education and PBL

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You have been asked to lead a meeting/workshop. The purpose of the meeting is to improve ALCORP's overall pay equity, ultimately to have ALCORP become a leader in equitable pay."

Marketing: "You are the manager of a new, upscale restaurant in Birmingham. A couple has ordered the two most expensive steaks on your menu. Soon after delivering their food, the server walks by their table and notices that the wife is frowning. She has just finished scraping the mushroom sauce off the steak to the side of the plate and is about to cut off her first bite of meat. As the manager of the restaurant, what would you like for your server to do next?"

Statistics II: Students were given a newspaper article discussing the high cost of textbooks for college students. Then the professor presented the following problem.

"What is the average textbook cost at Samford? Are there differences among different groups of students?"

Unit problems integrate and link several chapters or theories. For example, in the OB problem, students must consider communication, power and influence, leadership, and organizational change. In the marketing problem, students must consider characteristics of service, determinants of service quality, gap analysis, employee empowerment, and employee training. In the Statistics II problem, students must consider descriptive statistics, sampling, and variance. One key benefit of unit problems is their ability to move students to higher levels of learning, based on Bloom's taxonomy (Anderson Sosniak, 1994), by having them consider the connections between major theories and/or areas of content. Unit problems force students to consider problems from the perspective of several major theories and/or from several chapters of material. A challenge is that students often work on these problems outside of class, so team meeting time may be an issue. In addition, unit problems often require some in-class time so that student teams learn from one another and stay on track.

Field/Term PBL Problems

Field/term PBL problems are semester-long problems. Consider the following examples from Statistics I, Macro-Economics and Investments.

Statistics I: In these field PBL problems, students solved existing problems in local businesses. We worked with local businesses to identify appropriate problems and to set reasonable expectations for the student team's work. For example, one of the organizations, a steel company, asked the student team, "Was our investment in new manufacturing line equipment worth it?" The organization had pre and post data related to the new equipment, which the student team analyzed.

In other courses students solved a semester-long, staged problem or a highly complex problem.

Investments: Student teams acted as investment advisors and worked with clients and the many changes in their lives throughout the semester. As financial advisors, students had to work with their clients on planning for retirement, analyzing the funds needed to provide care for elderly parents, investing inheritance, and planning for college expenses for newly born twins.

Macro-Economics: Students examined and tried to explain the recent change in the relationship between unemployment and inflation in the Phillips curve. One student commented, "Alan Greenspan can't explain this, and you expect us to solve this problem?"

A benefit of the field/term project is the chance to consider highly complex and involved problems. Also, staging of a term-long problem can emphasize the links between the major sections of the course. We found the field problems required extensive faculty time to set up and to manage throughout the semester. These problems offered students a hands-on view of organizations and a problem they are currently trying to solve, and in some cases students found the complexity of the real-world problem solving surprising.

Comparing and Contrasting Problems

We have found that identifying these PBL problem types is helpful as we work to cover course content thoroughly. An awareness of PBL problem types allows easier adaptation of PBL across the curriculum by giving faculty options for each module and/or unit of the course. PBL problems provide a natural link to day-to-day business challenges. Topic-specific problems provide a way of introducing PBL and its related strategies and may be effective early in courses and/or in lower-level courses. Unit problems emphasize integration of related theories or concepts, while applying them to a complex situation. Field problems require an enormous commitment on the faculty's part, but do provide the most real-world problem. Term problems provide a means of ongoing integration of the course content and highlight the connections between separate units or modules of content.

Impact of PBL

We observed that PBL and the PBL problems used had an effect on both knowledge and skill development. In addition, use of the method affected student perspectives.

Knowledge development

We have found that PBL allows students to develop a more integrated business knowledge. Exploring PBL problems allowed links between theories and courses to become more grounded and more relevant. While we did not have quantitatively significant differences in terms of test scores in comparisons between our PBL and non-PBL sections, we did see differences in terms of students' perceived problem-solving skills. After this year, we will have longitudinal data in which we expect to see differences in test scores.

Skills development

We have found that PBL does increase our students' problem-solving skills. Students developed an appreciation for multiple solutions to problems and to working with team members on problems. Team assignments remain an issue since it raises the question of team grading and team free-riders, and their impact on the individual student.

Student Perceptions and Outcomes Associated with PBL Learning Strategies

We experienced normal change angst on the part of our students. Some of our students were in more than one PBL course (outside of the School of Business) at the same time, and this definitely affected the PBL experience, both positively and negatively. On average our students are positive, and as they have realized the type of work involved with PBL, what it means in terms of their learning and their future ability to perform, and its link to day-to-day business, we have more positive feedback.

Issues to Consider

Most faculty worked in teams to develop a PBL approach to each course. One of the benefits of our involvement in the PBL

continued on next page

Initiative has been the focus on teaching and the resulting ongoing conversations. Those conversations have resulted in diffusion of PBL across several faculty and increased scholarship about teaching.

One critical component of our success was the time and financial support provided through the Pew funding and the School of Business budget for extensive course design and development. Our faculty received summer support money for the time required to redesign and to incorporate PBL in their courses, as well as workload reductions when teaching their PBL courses for the first time. Faculty were cautioned to be ready to accept some of the typical negative outcomes of change: student dissatisfaction, less-than-hoped-for outcomes, and the necessity to respond to negative student feedback. PBL represents significant change for faculty and students, and while there are numerous positive outcomes, they typically come with some negative ones as well.

Ongoing Use of PBL in the Samford School of Business

The existing use of many active-learning strategies in business schools represented one of the particular challenges in implementing PBL in this discipline. Business education traditionally has used several active-learning strategies, and we use the case method extensively. For our faculty, PBL represents one of several active strategies that faculty can employ. We do not see our undergraduate curriculum being exclusively or primarily PBL; instead we see our curriculum incorporating a variety of active-learning strategies. We have worked to differentiate the process and outcomes of PBL, small-group and class discussion, repetitive working of problems (for example, in accounting), case method, gaming, simulation, and experiential exercise-learning strategies. We believe that our PBL efforts have enabled us to make this differentiation, and we want to share our findings with the educational community. ▲

Table 1

Summary of PBL Business Courses

Statistics I **Sophomore** T.W. Woolley	A combination of topic-specific and unit problems. Unit problems covered descriptive statistics, probability and sampling, association, estimation, and hypothesis testing. In some semesters the field project problem is done as well. These field problems involved solving a problem identified by a local organization using its data.
Macro Economics **Sophomore** M. M. Reed	A combination of topic-specific and term-long problems. Topic-specific problems explored core course topics, including but not limited to supply and demand, price ceilings and price floors, the money supply, and gross national product. The term-long problem asked students to explain the change in the relationship between unemployment and inflation in the Phillips curve.
Statistics II **Junior** J. B. Marshall	Unit problems for each of the major modules including demographics and hypothesis testing, analysis of variance, regression, forecasting, and non-parametric tests.
Marketing **Junior** M. A. Hocutt	Unit problems for the major areas of content including customer relationships and creating value through customer satisfaction and quality, marketing planning (segmentation, targeting, and positioning), and marketing strategies (new products, brand management, marketing of services, and promotions).
Organizational Behavior **Junior** K.S. Whelan-Berry	Unit problems for individual-, group-, and organizational-level phenomena, combined with several topic-specific problems. For example the organizational-level unit problem covered content on organizational structure and design, and organizational change.
Investments **Junior or Senior** J. M. Venable	Term-long problem given with several sub-problems given throughout the semester. Students acted as financial advisors to clients who went through many typical financial planning scenarios, such as inheritance investing, retirement planning, planning for college for children.

For more information, contact K.S. Whelan-Berry at the following E-mail address: kswhelan@samford.edu or visit the Samford PBL course description Web site located at the following URL: http://www.samford.edu/pbl/aboutsu4.html#PBL Courses

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With $750,000 Pew Grant, Samford Will Become Center to Conduct Peer Reviews of PBL Course Portfolios

The Pew Charitable Trusts, one of the nation's top ten foundations, has awarded Samford University a $750,000 grant to develop reliable ways to document the scholarship that goes into creating a Problem-Based Learning (PBL) course and to implement a system of assessing PBL courses through national peer reviews.

Two years ago, Samford received a $1 million grant from Pew to develop a series of 35 undergraduate courses and to establish a national clearinghous of information on PBL.

"While higher education has rewarded research more so than teaching in many instances, educators today are being urged to take teaching seriously," said Dr. John W. Harris, Samford Associate Provost for Quality Assessment and Director of the Samford PBL Initiative. "For this to happen, educators must be able to effectively document the scholarship that goes into designing and teaching a course, because as yet, no commonly accepted genre exists for doing so.

"This Pew grant will enable Samford to develop ways to document the scholarship of teaching as it relates to PBL courses, but the study could wind up documenting techniques that ultimately could be applied to courses in any type of teaching."

Samford will use the latest Pew grant to establish a national network to document scholarship and provide peer evaluation of the design, delivery and improvement of PBL courses. Also, it will discover the evolving best practices in PBL and report them nationally and internationally.

Two leading educators believe Samford's efforts will help improve student learning.

* Dr. Russell Edgerton, Director of the Pew Forum on Undergraduate Learning located at the Education Trust, Washington, D.C., said, "Having pioneered new methods of problem-based teaching, Samford will now attempt to invent ways to document and display these methods for peer review. If this project succeeds, Samford will have set a new standard for how faculty can and should treat teaching as scholarly work."

*Dr. Lee S. Shulman, President of The Carnegie Foundation for the Advancement of Teaching, added, "For an activity to be designated as scholarship, it should manifest at least three key characteristics: it should be public, susceptible to critical review and evaluation, and accessible for exchange and use by other members of one's scholarly community. We thus observe with respect to all forms of scholarship that they are acts of mind or spirit that have been made public in some manner, have been subjected to peer review by members of one's intellectual or professional community, and can be cited, refuted, built-upon and shared among members of the community. Pew's grant to Samford for a center to conduct national peer reviews of problem-based learning course portfolios offers American faculty one way to document the scholarship required to develop and deliver a 'powerful pedagogy'."

As part of the study, Samford will train faculty members at other institutions in writing course "portfolios," which are scholarly documentation of what goes on in a course explaining what, how or why students learn (or do not learn) in the course. Samford then will locate nationally reputable peer reviewers for portfolios. Much of the training and portfolio exchange will be via the Internet.

More information, including instructions on how faculty doing PBL courses can be assisted in writing PBL course portfolios, and how to submit them for national peer review will be published in future issues PBL Insight and posted on the Web at www.samford.edu/pbl.

Harris noted that the new PBL project "will explore different ways to construct and deliver course portfolios as well as various approaches to evaluating them validly and reliably." He added, "The project's purpose is to generate different approaches to documenting PBL courses and curricula. It is not to take one PBL course portfolio model and try to make it the dominant pattern."

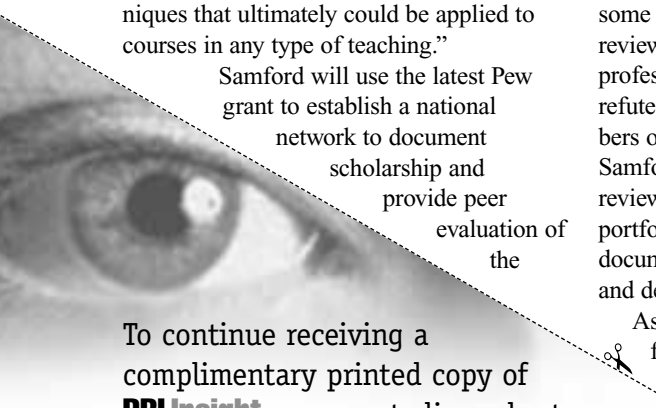
Because some of the best undergraduate PBL work is being done outside the U.S., the Samford study will be international in nature, said Harris. He cited programs offered by such schools as the University of Newcastle in Australia, Aalborg University in Denmark, Maastricht University in The Netherlands and Hong Kong Polytechnic University–each of which Samford faculty have visited in their efforts to study PBL. A Design and Assessment Team for the study will include representatives of these institutions, as well as such U.S. schools as the University of Delaware, Southern Illinois University.

Key steps in the Samford study will include:

* Researching ways to assess and document what students learn in PBL courses.

* Collecting course portfolios from a broad range of participants and distributing them for the peer review process.

* Sharing information through a web site, International Registry of PBL Course Portfolios, publications and professional meetings. ▲



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