Abstract – Problem-based learning (PBL) and case-based instruction (CBI) are instructional techniques that have been successfully implemented in a variety of disciplines. PBL and CBI promote students' skills in problem-solving, analysis, self-directed learning, and collaboration. It is, however, a creative and often time-consuming task to discover, design, and present a good problem or case that is attractive to students, appropriate for course content, and relevant to the subject. We have attempted to master PBL and CBI techniques through a Faculty Learning Community (FLC), in which a group of six faculty members from diverse disciplines worked together to develop a joint, multi-faceted case study.

As the FLC explored PBL and CBI techniques, the group discovered that the FLC provided a rich environment for sustained intellectual exchange. In this paper, we describe the experience of the group as a whole as well as the learning experiences of individual FLC members. Our experiences show that FLCs are an effective, engaging, and inexpensive way for faculty members to learn new teaching approaches such as PBL and CBI.

I. Problem-Based Learning and Case-Based Instruction

Problem-based learning (PBL) is a type of learning that is initiated by a posed problem, query, or puzzle that the learner wants to solve [2, 6]. Case-based instruction (CBI) is a teaching technique that employs real-world problems or scripted scenarios to encourage students’ skills in problem-solving, analysis, self-directed learning, and collaboration [16]. CBI has been successfully implemented in a variety of disciplines, including medicine [19] and business [5]. It is, however, a time-consuming task to create a well-designed case that is relevant to the learning goals of the course and captures student interest.

II. Faculty Learning Communities

Faculty learning communities (FLC) are small cross-disciplinary groups of faculty members who meet regularly during an academic year to establish a supportive environment for the exchange of ideas and engage in a series of activities focused on teaching, learning, and scholarship [3, 4]. Blending task and process, faculty participants engage in collaborative projects, attend seminars, retreats, and social events to foster professional development and build community. Miami University, a pioneer of the FLC approach, has used faculty learning communities extensively as a faculty development tool. (See: http://www.units.muohio.edu/flc/.)

Learning communities can be cohort-based or issues-based. Cohort-based communities consist of a group of faculty with a common interest; for example, faculty who teach introductory science courses may examine scientific literacy for non-science majors. Issues-based communities consist of faculty exploring special university-wide issues such as critical thinking. Faculty learning communities can act as powerful change agents that significantly impact the teaching culture of an institution. In addition, they promote collegiality, support innovation in the classroom, and improve student learning.

III. Ohio University PBL/CBI FLC

In 2003, Ohio University launched nine faculty learning communities through a collaborative effort titled SCOPE Ohio.
model, as depicted in Figure 1, to help the group members apply the techniques to cases focused on issues in our own disciplines. What emerged from these discussions was a relevant and familiar to all of us. While none of us knew what outcomes to expect. The group knew, however, that in order to establish a supportive environment for the free exchange of ideas and engage in activities focused on case-based instruction trust had to be established first. With good leadership and group commitment, we enjoyed a number of activities that may have seemed off-topic but that moved the group steadily toward creating a comfortable, trusting, and intellectually stimulating dynamic. Our activities included:

- an opening evening retreat on October 7, 2003, which was the first FLC gathering;
- a pottery painting session on October 24, 2003, which was the second FLC gathering;
- study sessions based on common readings, include books such as [8, 22];
- faculty-student dinners that involved students in our discussion on teaching and learning; and,
- at the end of the 2003-2004 academic year, a weekend morning retreat to reflect on our progress and plan our continuing work in the FLC.

Through this process the group remained mindful and committed to the goal of learning about and implementing PBL and CBI. After initial discussions of PBL and CBI techniques and sharing of each other’s experience with case studies, we sensed that an effective way to master the art of case writing could be the development of a joint case study. We chose the topic of distance education, because it is relevant and familiar to all of us. While none of us knew whether or how to implement this particular case study in our specific courses, we did expect to develop case-writing skills through the development of the hypothetical case and then to apply the techniques to cases focused on issues in our own disciplines. What emerged from these discussions was a model, as depicted in Figure 1, to help the group members identify the various perspectives we held on the topic of distance education.

At the center of the model in Figure 1 is “distance education,” the central topic. The circles that surround and connect to “distance education” are various perspectives of this topic. For example, one perspective is the issue of cheating. In distance education, online examinations may take place without proctors. Many interesting questions could arise from this perspective. Will there be new forms of cheating? Will students be more likely to cheat? What measures can instructor take to prevent cheating? Can technology help provide a solution to this problem? Similarly, questions could arise from every other perspective in the model. All of these questions could lead to conflicts and discussions in the joint case study.

The group used this model as a way to organize our thinking about and writing of our hypothetical case. Although the group identified goals leading to tangible results, such as, jointly constructing a case study, as the group reflected on the experience of being a part of the FLC, the members recognized the importance of the process experienced in the attempt to produce those results.

Figure 1. A model of the topic of distance education.

The next section presents the joint hypothetical case that we developed for the topic of distance learning. The following section shares individual members’ experiences of applying the techniques they learn from the development of this joint case to their own courses. The last section offers concluding remarks.

**THE JOINT HYPOTHETICAL CASE**

Based on the model of issues related to distance education that we developed, as shown in Figure 1, we constructed a joint, multi-faceted case that can be used in a hypothetical course on distance education. The background information of the case in
Table 1 is intended to be presented to students in the beginning. Then, depending on the focus of the discussion, different conflicts and scenes in that context will be presented to students. For example, if the focus is “pedagogical implications,” which is one perspective in the model in Figure 1, the example scene of the conflict in Table 2 can be presented to students to stimulate thoughts. After that, suggested questions listed Table 3 can be asked to further provoke in-depth discussions. For each suggested question, we prepare follow-up questions for all anticipated student responses. Due to space limitation, we include anticipated student responses and suggested follow-up questions for only one question in Table 3.

In addition, we prepare suggested activities that students can complete as homework assignments. The suggested activities for the scene listed in Table 2 are also included in Table 3.

Similarly, for all other perspectives in Figure 1, in the context of the case in Table 1, we can prepare conflicts and scenes, and corresponding suggested questions, anticipated student responses, suggested follow-up questions, and suggested activities, as shown in Table 2 and Table 3.

From this joint case study, we learned how to construct, organize, and present a case, and which key components should be included in a case study.

Table 1. Background information of the joint case.

<table>
<thead>
<tr>
<th>Case Background</th>
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<tbody>
<tr>
<td>The Department of Information Technology at Olympia University has about 400 undergraduate students and 200 graduate students. All undergraduate students are full-time students who live either on campus or near the university, so are about half of the 200 graduate students. The other half graduate students are students with full-time jobs, for whom the department offers evening classes and distance-learning classes. These students live within commuting distances from the university. The degree requirements for all graduate students are the same. The Department of Information Technology is considering expanding into a remote foreign market in India to reach the students there. The department plans to offer both undergraduate and graduate programs in India. To do this, the department plans to offer online versions of all undergraduate and graduate courses. In addition, to limit the number of different versions of the same courses, the department plans to eliminate current evening classes and distance-learning classes for graduate students with full-time jobs, and require them to take online classes instead, in which there will be no more face-to-face sessions.</td>
</tr>
</tbody>
</table>

Table 2. A select scene of the joint case.

<table>
<thead>
<tr>
<th>Conflict 1 Scene 1</th>
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<tbody>
<tr>
<td>Dr. George Martinez walks into the mail room to find his colleague, Dr. Pippa Sinclair, surrounded by the mail that had fallen from her hands. As he stooped to help her pick up the papers, he could tell that she was very angry.</td>
</tr>
<tr>
<td>Dr. George Martinez: Is everything OK, Pippa?</td>
</tr>
<tr>
<td>Dr. Pippa Sinclair: Oh, just fine. I just learned that I have to overhaul all my courses before the start of next quarter.</td>
</tr>
<tr>
<td>George: Why would you have to do that?</td>
</tr>
<tr>
<td>Pippa: I just came from a department meeting. My chair informed me that from now on, my class will be one hundred percent online. In fact, we’re offering online versions of ALL our undergraduate courses and half of our graduate courses! The department said the decision is final and there is no opportunity to protest.</td>
</tr>
<tr>
<td>George: Oh my goodness, what are they thinking?</td>
</tr>
<tr>
<td>Pippa: They’re thinking they’re going to earn a lot of money by expanding the program to include students in India. The university wants to move quickly but I’m concerned that the course will have to be watered down if we make it an online course. You may have to make the changes as well. All courses required of our majors will have to be offered online.</td>
</tr>
<tr>
<td>George: Well, maybe it won’t be so bad.</td>
</tr>
<tr>
<td>Pippa: Not so bad!!! Online learning is an unproven pedagogy. Is online learning effective? I’ve been teaching for fifteen years and I know face-to-face instruction is very effective. My students have always been very successful after graduation.</td>
</tr>
<tr>
<td>George: What have other faculty said?</td>
</tr>
<tr>
<td>Pippa: Most of us are concerned about the impact on student learning. All of us except Enid Larson. She is so excited about getting a new laptop and using some computer program that she has read about.</td>
</tr>
<tr>
<td>George: I’m sure you’ll work it out. I better get going – my chair called a meeting for this afternoon. I wonder if it’s to tell us that we have to go online as well.</td>
</tr>
<tr>
<td>As George’s footsteps echo down the hall, other faculty could be heard scurrying to department meetings of their own.</td>
</tr>
</tbody>
</table>
APPLICATIONS OF CASE-DESIGN TECHNIQUES

While the joint hypothetical case described above has not yet been used directly in any courses taught by FLC members, individual FLC members learned various CBI techniques from the development of this joint case and applied these techniques in courses in different disciplines.

I. “Software Design and Development” by Liu

CS456/556 “Software Design and Development” is a dual-listed software engineering course offered to upper-level computer science and computer engineering undergraduate students, as well as computer science graduate students. It has been offered five times by Liu in the past two and a half years. This course primarily covers the Unified Software Develop Process [9]. Additionally, communication topics important to software engineers are weaved into this eleven-week course [11, 14, 20]. A major component of the course is quarter-long team projects, in which students are required to work in teams and apply the Unified Software Develop Process to develop a software prototype. These projects are service-learning projects for clients from local communities [10, 12, 13, 15].

Before Liu learned PBL and CBI from the Ohio University PBL/CBI FLC, he typically used short examples from the textbook [9] to teach various phases of the Unified Process. For example, the first phase of the Unified Process is the requirements phase, in which initial requirements from clients are captured and described in a use case model. Liu would first go through a one-hour presentation to introduce key concepts in this phase, such as actors, use cases, use case diagrams, use case models, and the requirement capture workflow. He would use fragmented examples from the textbook to illustrate these concepts. After that, students would be asked to engage in classroom exercises to apply these concepts. In these exercises, a description of a hypothetical system would be supplied. Students would then try to identify actors and use cases, develop initial use case diagrams, and construct use case models for that system. They would perform these tasks in a step-by-step fashion. Liu would walk around the classroom, observe student progress, and provide assistance when needed.

With this traditional way of teaching, students were able to understand and apply the key concepts. However, they did not know if the models they constructed would become problematic in the context of the full lifecycle of software system development, because they did not have a chance to observe the consequences of their modeling decisions in these exercises. After Liu was exposed to PBL and CBI from his participation in FLC activities, he found a way to alleviate this problem. He selected a complete project document from a previous CS456/556 student team and developed it into a case suitable for instructional use. The case consisted of several sections, each corresponding to a phase in the Unified Process. At the end of each section, a number of questions were asked regarding the effectiveness of project documents in that section as well as potential problems they may cause. When this case was used in class, students gained a better understanding of the pros and cons of various modeling and design decisions because they could see concrete results of these decisions from the case document. In a survey administered to Spring 2005 CS456/556 students, among 31 anonymous responses to a five-scaled survey question on the helpfulness of the cases, 18 (58%) stated that the cases were “very helpful,” 8 (26%) answered “helpful,” 3 (10%) chose “neutral,” only 2 (6%) considered them “not helpful;” none chose the answer “not helpful at all.”

II. “Psychology of Learning” by Drumm

Drumm is a psychology faculty member whose participation in the FLC has helped him improve one of his regular courses so far, and he expects to modify additional courses in the near future. Initially, the FLC considered the general issue of active learning in students [8], and concluded that problem-based and case-based learning compared favorably. Drumm decided to apply some of the ideas in the literature on PBL and CBI to a course he was about to teach and in which he had been considering making changes. Specifically, he intended to

Table 3. Teaching notes for the conflict and the scene listed in Table 2.

<table>
<thead>
<tr>
<th>Teaching Notes</th>
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<tbody>
<tr>
<td><strong>A suggested question:</strong></td>
</tr>
<tr>
<td>• Should Pippa be required to teach online?</td>
</tr>
<tr>
<td><strong>Anticipated student responses and suggested follow-up questions:</strong></td>
</tr>
<tr>
<td>• Students may argue that Pippa should be required to make the change because it is her job.</td>
</tr>
<tr>
<td>o Ask students what if Pippa is extremely arthritic and cannot type for long periods.</td>
</tr>
<tr>
<td>• Students may argue that Pippa was hired to teach traditional classes and it is not her job to teach online.</td>
</tr>
<tr>
<td>o Ask students about the need for other workers to adapt to new technologies. For example, when computers were introduced into cars, automobile mechanics had to learn to perform new types of repairs.</td>
</tr>
<tr>
<td><strong>Additional suggested questions:</strong></td>
</tr>
<tr>
<td>• How should the transition be managed?</td>
</tr>
<tr>
<td>• What impact will the change have on student learning?</td>
</tr>
<tr>
<td>• Do you have experiences with online classes? What are they?</td>
</tr>
<tr>
<td>• What specific support, in terms of training, equipment, time release, additional pay, etc, should the university provide to faculty making the transition?</td>
</tr>
<tr>
<td>• Direct students to additional sources such as [17, 18] where similar case are described, and invite students to compare the situations.</td>
</tr>
<tr>
<td><strong>Suggested activities:</strong></td>
</tr>
<tr>
<td>• Ask students to interview people who have gone through a major transition at work, such as the merger of two companies or the introduction of outsourcing.</td>
</tr>
<tr>
<td>• Ask students to interview teachers to learn about what they find most enjoyable about teaching.</td>
</tr>
</tbody>
</table>

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T3F-12
incorporate particular problems as pedagogical innovations in his “Psychology of Learning” course, which seemed to lend itself well to such innovations [9, 21].

This is a course that emphasizes animal learning as a way of inferring general learning principles that apply to organisms in general, including humans. This course, when taught in a traditional lecture format, often presented Pavlovian conditioning and instrumental conditioning, for example, as sets of principles, along with the research findings that supported them. Instead, Drumm divided the class into groups whose tasks were to figure out for themselves what was going on [1] in a variety of conditioning situations set up and conducted by the students in the class. For example, a student exposed a dog to the sound of a tone followed by food. The dog licked its chops under these conditions, as well as later when the tone was presented alone (i.e., Pavlovian conditioning). The students together designed and built a maze, then each group ran a rat for numerous trials from a start box to a goal box in which a food reward was placed (i.e., instrumental conditioning). Each student wrote up and interpreted the observations made by their group. In this fashion, the students discovered for themselves concepts that many students in traditional learning courses have found difficult to grasp. The instructor endeavored to make it clear to students in the syllabus, and occasionally in class, that he was functioning more as a facilitator/choreographer, whereas the burden of discerning what was going on in the exercises was up to them. End-of-quarter evaluations were overall positive.

III. “Systems Analysis and Design II” by Wolfe

Wolfe is a faculty member in the two-year Computer Science Technology (CTCH) program. Second year CTCH students are required to take Systems Analysis and Design II (SAD2), a course in which the students are expected to reinforce and demonstrate their mastery of topics studied in earlier CTCH classes. The material used to be presented in five independent sections, one for each step in the Systems Development Life Cycle. Because of her participation in the FLC, Wolfe believed that presenting a unified case as the basis for all steps would lead to greater understanding by her students.

The changes made to the SAD2 course were significant. Although the students covered the same material as in the past and used the same textbook, the format of the class was different in several ways:

- Instead of working individually, the students organized themselves into work groups in order to analyze the case and arrive at a solution.
- Instead of working on distinct sections of work, the groups completed a single project for two outside clients.
- Instead of performing exercises from the textbook, the students worked on tasks they identified as being necessary in order to complete the project.
- Instead of working with assigned tools, the students identified software tools that they felt they needed to know to complete the task and then learned the material.

The new approach began the very first day of the quarter. In preparation for selecting their teams, the students brainstormed the skill set that would be needed by their group. Afterwards, students prepared resumes in which they included the subset of those skills that they possessed or felt they could achieve in time for the project. Following the speed-dating model, on the second day of class, every student interviewed every other student and then submitted a list of the classmates they felt would make a well-balanced team. From these lists, Wolfe constructed three teams, each working independently on the same problem for the outside clients. In all three teams, the level of engagement in the class appeared to be greater than that of earlier quarters. Absenteeism was almost nonexistent as the team members felt a need to meet with their teammates. The quality of questions asked by the students improved from previous quarters. This quarter, the questions were not of the do-we-have-to-know-this type but instead were of the how-do-I-do-this or what-else-can-I-try type.

At the beginning of the quarter, students were unsure of this new approach and were worried that they would not know what they had to do to get a good grade. By the end of the quarter, they were very enthusiastic about the approach and expressed in the course evaluations that they felt their knowledge level had greatly increased and that they were encouraged about their ability to perform in the workplace after graduation. As an instructor, Wolfe felt that her class received a more realistic appreciation of the value of performing the individual tasks required during systems development because they were able to experience the tasks in context.

IMPACT OF THE LEARNING COMMUNITY EXPERIENCE

In May 2005, five FLC participants completed a survey to assess the impact of the learning community experience on their professional development. A Kolmogorov-Smirnov one-sample test was run for each of the five scaled survey questions to which FLC members responded. For Question #1, “Were the FLC activities helpful to you in general?” the maximum deviation indicated that FLC respondents found the group’s activities generally helpful (D = .8, p < .01). There was no evidence that FLC members displayed a particular level of familiarity with case-based instruction prior to their participation as assessed in Question #2, “How familiar were you with problem-based learning and case-based instruction before you joined this FLC?” (D = .4, ns). On Question #3, “Now, how comfortable are you with using problem-based learning and case-based instruction in your classes?” respondents said they were comfortable with CBI after having participated (D = .6, p < .05). For Question #4, “How has your participation in this learning community affected your views of the scholarship of teaching and learning, both within your discipline and beyond your discipline?” respondents indicated that it had made an impact (D = .6, p < .05). Finally, on Question #5, “Would you recommend that your colleagues join a FLC?” all respondents said they would “certainly recommend” participation to others (D = .8, p < .01). The FLC participants were also asked several open-response questions.

6 ns: non significant.
regarding their initial interest in joining a learning community, barriers to participation, and most valuable aspect of the experience. The participants commented on collegiality, the opportunity to share ideas, and the support they felt from fellow faculty members in learning and adopting new teaching methods. In summary, the survey result showed that the FLC experience had a positive impact on the participants.

**CONCLUSIONS**

While continuing education and professional development expectations in many professions are clearly defined, such is typically not the case in higher education environments. For example, practicing physicians need to accumulate training hours annually to keep their state licenses active. Similarly, K-12 school teachers often must receive a specified number of continuing education credits each licensing renewal cycle and, in some states earn master degrees, in order to maintain their licenses. Yet, in universities where the challenge in teaching and learning could be more demanding, clear faculty development measures are not required or defined.

We believe that FLCs may provide a unique opportunity for professional development in higher education environments based on engagement in sustained intellectual exchange with colleagues in diverse disciplines who have different research interests and teaching experience. Further, they provide an effective and inexpensive way for faculty to learn new teaching. As stated earlier, individual faculty members participating in our FLC were not sure what to expect from the experience beyond the chance to learn PBL and CBI techniques. What we found was that in the context of the relaxed, friendly, and supportive atmosphere of the FLC we were able to learn new teaching strategies together and engage in conversations that increased our understanding of each other’s field, challenged us to examine constructs and assumptions of our own disciplines, and enriched our teaching. Most importantly, the FLC provided much needed peer support when problems in implementing new teaching strategies were encountered.

The success this FLC has achieved as a group is a result of two important factors. First, the group valued and attended to community building rather than focusing exclusively on specific goals and tasks. Second, the group agreed to focus on a project that was relevant to all of us rather than isolating individual efforts within specific disciplines. These factors provided a framework within which all group members felt invested in the process and the product, and allowed all of us to enjoy collegiality, perhaps at its best.

**ACKNOWLEDGEMENTS**

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