SERVICE-LEARNING AND ACTIVE-LEARNING: AN EXPERIENCE-BASED COMPARISON

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Abstract

I view the service-learning paradigm as an augmentation of the traditional view “learning in order to serve” by an added emphasis on the service, as in “serving while learning.” I argue that service-learning fully supports active learning, critical thinking, and creative thinking. I describe my experience in designing a service-learning course on Software Engineering in Computer Science Department at Louisiana State University, including students’ feedback on their experiences and the key factors behind the success of the course.

1. Introduction

My main goal here is to report some useful observations on service-learning based on my senior-level undergraduate service-learning course on Advanced Software Development (CSC-4330), in Fall 2009 at Louisiana State University (LSU). I have been reorienting myself for two years from the traditional style of teaching to a new style encompassing the concept of active learning, with explicit attention to promoting critical thinking and creative thinking. One component of this reorientation is a shift from the emphasis on technical or theoretical elegance of a method or a concept to an emphasis on the elegant and non-trivial applications of a concept in solving diverse and useful problems that arise in real-life situations. Thus, I allocated more class time than before to show how a problem can be abstracted and viewed in different ways and how they lead to different solution approaches. Active-learning or “learning by doing” is well-known to be more effective in getting a better grasp of a concept and in using a concept in problem solving; active-learning also supports knowledge retention irrespective of differences in students’ learning styles [1, 2, 4, 5, 9, 10]. My jump to teach a service-learning course would have been far more difficult if I had not been already practicing the active-learning principles [7] in my teaching.

One can say that service-learning actually involves active-learning (including critical and creative thinking) in a more intense and broad fashion for each of the following major categories of learning objectives in a course: (1) problem-identification, (2) determining potential solution strategies, (3) analyzing the merits of those strategies and selecting a particular one, and finally (4) developing a solution. When service-learning is combined with teamwork, as is often the case because of group projects, the students experience the importance of both technical communication (on scientific merits of various solutions strategies) and interpersonal communication (in consensus-building by overcoming personal barriers) to reach a solution that is both technically sound and emotionally or politically acceptable. Service-learning provides a richer learning experience than the active-learning itself due to the presence of an external real-life “user” of the service. In service-learning, the students also explore ethics and social (civic) responsibility. In my service-learning course, some students selected their projects based on how they perceived the (non-profit and local) client-organizations’ service were helping people in the community to improve their lives. One can view service-learning as service + (semi-unsupervised) active-learning.

2. Success Factors in My Service-Learning Course

There are several key factors that contributed to the success of my service-learning course. First, I started contacting and meeting with the representatives of the potential client organizations during Summer-09 in preparation for the Fall-09 class. This was greatly facilitated by the Center for Community Engagement, Learning and Leadership (CCELL) at LSU, which maintains a large database of potential client-organizations in the Baton Rouge area and provides training and other services to the faculty in developing service-learning courses. The meetings with the client organizations helped me to understand their needs and assess whether those needs can be matched with the learning objectives of the service-learning course. Fortunately, I had plenty of choices in selecting the final four organizations to work with. It took several weeks to complete the selection process; it was critical to complete this before the start of the service-learning course in Fall-09.

Second, I built the trust with the representatives of each of these organizations and developed a good understanding with them about what we are going to be able to
do for them. The fact that some of these organizations had done service-learning projects with courses from other departments at LSU was also helpful. My service-learning course was the first one in Computer Science department. Third, I had attended a 10-week Service-Learning Faculty Scholars Seminar at LSU organized by CCELL during Spring-09, which prepared me well for handling the various facets of designing a service-learning course.

Fourth, I kept close contact with each client-organization throughout the semester and received feedbacks on the progress of student-projects. I invited them to the first day of the class to give a short (20-30 minute) presentation about their organization and the projects they want the students to do. Some of the representatives even stayed on to see what the other organizations were presenting in order to get a feel for the competition they faced in attracting the students to their service-learning projects. Each presentation was followed by a 10 minute question-answer period. These presentation greatly helped the students to get a good feel for the available projects to choose from and also a good feel for the representatives of the client organizations with whom they would be working. In particular, each student stayed on with his/her initial selection of the project and no changes were needed. I also requested each client-organization representative to be present at the end-of-semester final project presentations (40-50 minutes) for the project of his/her organization and to assign a score for both the content and the presentation style, in addition to an overall score for the project itself. The representatives and the students were told in the beginning of the semester that these scores would be accounted for in the final project-score. This added responsibility helped in keeping the client organization representatives engaged and interested in the projects throughout the semester. The client-representatives also generously gave their time and met with the students one or more times for each two-week period (and additional meetings when requested by students). This, in turn, strongly motivated the students to do a good job in the projects. Other senior officers from two of the four client organizations attended the final project presentations to show their support.

I used end-of-semester feedbacks from the students on their learning experience and the feedbacks from the client-organizations on their satisfaction with the student projects to measure the success of my service-learning course. The students reported an 85% satisfaction and the client-organizations reported a 95% satisfaction.

3. Service-Learning vs. Active-Learning

In traditional "learning in order to serve", the service is not the main focus; one simply presumes that it would happen at some future time after the formal classroom learning is over. However, it is clearly the service part, i.e., the application of the learned knowledge to improve people's lives that justifies all our efforts and resources spent in support of knowledge creation and learning.

We use knowledge primarily in two ways: generating new knowledge (as in pure research) and creating new applications in everyday uses and services (as in applied research). Just as diamonds are not found everywhere and we have to work through a lot of earth to find a small piece of diamond, the applied and practical knowledge likewise forms only a small part of the total knowledge we create and our real interest lies only in that small part. The notions of critical thinking and creative thinking, which form the core of active-learning, apply to both the creation of new knowledge and the creation of new applications of existing knowledge. In service-learning, the active-learning takes place with a focus on the service, the "diamond" core of the practical use of knowledge.

I believe that most courses in each discipline can be transformed with some effort to a form where active-learning takes place within the context of service-learning. We just need to integrate the classroom learning of new knowledge with some form of service-use of that knowledge outside of the classroom to benefit some common good [11]. The service can be in an indirect form solving a specific problem that some non-profit organization has or in a direct form, say, tutoring some group of students on skills and concepts related to that new knowledge. A music student in a piano class, for example, could give a "service" by performing in a nursing home or by teaching piano in a high school which may or may not have a piano teacher. (Note that teaching piano to an individual free of cost under a private agreement would not fall under service in service-learning; the service-learning is always tied to and occurs in parallel with a classroom-learning.)

In a traditional non-service learning course, the end-of-chapter exercises and practice problems make at best a minimal explicit connection with applications and justification for what is learned. The primary focus remains learning the course-specific technical concepts. The exercise problems are often toy-problems that are distantly related or are abstracted from real-life applications, where that relationship is not always made clear. As a result, the learning in this situation often takes place in an out-of-context and abstract mode, making the learning incomplete in terms of knowledge application as it fails to connect the students with the problems that they are to solve when they join the professional workforce. Active-learning is not as comprehensive and broad as service-learning; pure active-learning is more suitable to improve concept-learning and knowledge creation while service-learning is more suitable to improve knowledge application [12].

One may wonder if it is necessary to involve a participating community partner organization in a service-
learning course. In a very objective sense, the answer is "no." If we could put a "personal face" behind every exercise problem that the students solve in a course such that a solution to these problems will directly benefit the well-being of that person, then one could say that the course is service-learning. It must not be the case, however, that the solution would just abstractly satisfy an intellectual interest or curiosity of that person; that would make it fall in the category of knowledge generation rather than knowledge use as in service-learning. The presence of a client organization is simply a practical way of putting a personal face (of a real-life community partner) behind the problems that the students in a service-learning class solve; it gives the problems a real-life touch.

4. Role of Service in Service-Learning

In service-learning, the service-part and the learning-part are both given primary importance by bringing them together in immediate proximity. The serving part provides a direct context for learning; it forces the students, for example, to abstract and identify the technical issues involved in the specific real-life problems faced by the participating partner organizations. Because a poor abstraction can lead to a poor or ineffective solution, the importance of proper problem abstraction is obvious. This new dimension in a service-learning course is an important component and is shown by the bold line in Fig. 1(i).

Unlike learning a technique or a concept first and then looking for a problem to apply it, in service-learning one first critically examines the problem in hand and then looks for a technique to solve it. This makes one a better learner and a better problem solver. Determining what is to be learned is in itself a part of the real learning process, and is in a sense more important. In service-learning, a student learns with an immediate demand on applying it, and his/her work extends beyond the classroom and the instructor. This motivates the students to apply themselves more fully and they experience a deeper sense of learning and a better knowledge retention [3].

Fig. 1(ii) shows a model of active-learning similar to Fig. 1(i) for ease of comparison. In active-learning, the problem solving experience may lack a real-life touch. The real-life problems are typically unstructured and unfiltered, and they often appear in ambiguous forms. In active-learning, the practice problems are determined purely by the course content. The instructor may need to formulate these problems in a special form to promote critical and creative thinking, which are central to active-learning. In [6], we presented several general techniques for creating such problem formulations based on Entity-relationship models of the technical concepts. This approach is consistent with the notion that knowledge itself has its own design [8].

Form yFall-09 service-learning course, the class enrollment went up by more than 50% (37 students compared to 22 students in Fall-08), and this can be attributed...
4.1. Course adaptation

For my CSC-4330 service-learning course, the course adaptation to the service-learning projects occurred in two ways: (1) the course contents, and (2) the order in which they were covered. First, since all the projects involved a great deal of web-development and only a small amount of programming (in Java), a good part of the course content involved web-design and web-modeling techniques. In previous offerings of this course, there were no service-learning component and only a few group projects would involve web-development. These groups chose to include web development in their project simply because some group members knew web development. The web-development was not taught at that time and the course focused on the traditional software engineering techniques. In particular, the webpages in those projects were mostly static and not as elaborate as those in the service-learning version of the course in Fall-09.

For the second kind of adaptation, I needed to cover web-design issues early so that they could be used in the service-learning projects. There was also considerable more emphasis on requirements engineering. This proved worthwhile because the students ranked this one to be one of the most valuable course topic for the project. Among the software process models, the traditional Waterfall (WF) model was given less attention in view of its less relevance in the course projects; a variation of the Extreme Programming (XP) model was a better fit.

4.2. Students as teachers in service-learning

For my service-learning course, the students reported a positive and enjoyable learning experience working with the representatives of the client organizations who had a very different professional background. The client-organization representatives also reported a good learning experience in interacting with the students, who were mostly seniors in Computer Science and who knew a lot more about web-based information system designs. The students could suggest many useful options for the website functions beyond what the service-client representatives could imagine. The students helped the clients to reorganize the web-contents to fit the enhanced functionalities, helped them in designing the back-end databases, and provided better query-interfaces for them to use those databases. In some cases, the students also trained the clients in editing the web-contents.

4.3. Service-Learning course level

A senior or junior level service-learning course is, however, more likely to be effective than those in the first two years. By that time, the students have gained a good bit of diverse technical knowledge and gained considerable personal maturity that they can bring to bear on the service-client projects. (Many students in their freshman and sophomore college years need training in even such basic matters as studying for exams, managing the personal time, developing study skills and note-taking skills in a lecture, etc.) The regular classroom learning provides the students a more structured and simplified learning environment, which is helpful in preparing them for the more challenging tasks of handling a service-learning environment and play the role of a teacher when needed.
5. Service-Learning Experiences

We summarize below some specific learning-experiences that the students reported as valuable in the end-of-semester feedbacks.

5.1. Coordination with group members

A common problem in a group project is finding a suitable time where all group members can be present. Because each student has his/her distinct class schedules, this can be non-trivial. A slight cooperation can, however, make this task a lot easier. Once the meeting schedule is set for the semester it is important that each member makes an effort to attend the meetings. Occasionally, someone may miss one or two meetings because of unforeseen developments. But then it is important that that person is kept abreast of the discussions and decisions taken so that he/she does not feel alienated. The alienation of one member can cast a bad spell on the whole group project. The importance of coordination can only be experienced by working in a group; no amount of classroom lecture can compensate the actual experience.

It is important to assign a specific person the responsibility of setting the meeting agendas in consultation with the group members; some other group member can be assigned to record the key ideas discussed in the meetings and note the decisions taken, and distribute them to each member following the meeting. This is a simple and a sure way to get the most benefit out of a meeting. These roles can be rotated among the group members, if desired. Unless each member feels the benefit of participating in the meetings and feels that his/her presence is appreciated, he/she may start missing the meetings and this can quickly cause a group project to fail.

5.2. Group-learning experience

An important part of the experience in working in a group is compromising on conflicting preferences of the group members to arrive at a decision that is acceptable to all. The importance of this experience is that the users in the open market-place have different preferences and thus the first test of the market-place success of a product is that the product is liked by all the group members.

5.3. Communication with the client

It was universally recognized by all students that understanding what the clients wanted was a real challenge. Each time the students tried to make a detailed list of a client’s needs, they quickly realized that there was a big gap between what the students understood or thought the client wanted and what the client meant. This occurs mostly due to the use of different terminology and concepts. In addition, there is also a difference in the way each side views at the web-based software system to be built. It is only after several meetings and long discussions back and forth with the clients that the students could get a handle on the final set of requirements. The cooperation of the clients and the patience of both sides at this stage were very critical. Also, open discussion of the potential modification and suggestions of different ideas from both sides were key to the success of this stage.

5.4. Changing Project Requirements

It is a fact of life for all real projects, large and small, and experienced and inexperienced clients, that the project requirements will change with time. There will be changes even as the project gets started and more changes on the way to the project’s completion. New requirements will appear as the client’s problem changes over time, some of which may arise from competing products in the market. It is difficult to visualize the complete picture of a project for all but the most trivial ones, and this is no different for website development projects. One can always find new things to have on a website or on a webpage such as a calendar facility or a search facility. One can also find a better ways of doing the same thing, e.g., presenting the information on a webpage.

Adapting to the demands of the client and at the same time keeping the project on schedule is a skill that can only be learned on the job. At times one has to politely say "no" to a change-request and convince the client that postponing the change is the right thing to do.

5.5. Reinforcement of course-material learned

Of all software engineering concepts that I covered in the lectures, the two topics that I particularly emphasized were: (1) determining the requirements and modeling them as a finite-state system to get a better understanding, and (2) menu design. The student feedbacks indicated that these two topics were also most useful for the service-learning projects, reinforcing the importance of classroom learning. A third topic that also received a high score in student-feedbacks was the use of Gantt chart and PERT charts for project planning and tracking in terms of scheduling the activities and resource (man-hours) allocation. The nature of the student-projects made the traditional topics software process models and software testing methods somewhat less useful, although a good amount of class time was devoted to the latter topic because of its general importance in software development.

The menu-design techniques also proved to be very useful in the webpage layout design, which is part of the broader topic of user-interface design. A poor layout can mean loosing the interest of a valuable customer; i.e., a visitor for that webpage. The challenge in a webpage design is to keep the visitor on that page or on its related
websites once he lands in that page. It must be therefore easy for the visitor to navigate through the information on that webpage and guide him to the related information in other webpages. This, in turn, means the web designer must clearly understand the information needs of the visitors, both in terms of what they want to see and where they expect to find that information. The choice of colors and the size and fonts for the texts must be crisp, pleasing to the eye, avoid confusion, and avoid the information overload and yet have as much relevant information at-hand as possible. This means one has to carefully structure the information in a hierarchical fashion or network structure to allow a simple navigation through the information. The navigation-pathways through the webpages must closely correspond to the common information-processing pathways of the prospective visitors.

5.6. Slow start vs. quick finish

A common experience was that in the beginning the project moved slowly, sometimes up to middle of the semester after the requirements were finalized. In some cases, much time went in deciding the web-design tools to be used, which depended on the skills available in client-organizations for maintenance vs. the ease of web-development by the student-project teams who were more technically savvy. Different projects used different tool like WordPress, Drupal, and Ruby on Rails. The students appreciated this experience of slow-start and then gaining speed as the project moved forward. Many of them reported the last two weeks being the most productive.

Once the decision on an implementation tool were made, the projects typically picked up speed. One group had some members with more web-design experience and they used the web-design tool Drupal for its many low-level design flexibility.

5.7. Over promising and under delivering

One of the key lessons students learned was not to over promise and under deliver. Once they understood that the strict time constraint of a semester meant a complete solution to meet all of the client’s requirements was not possible, although technically feasible, they focused on the most important functionalities that would provide a stable platform on which the future extensions could be built. This proved to be satisfactory to the clients. This also meant that a lot of extra time had to be spent on carefully choosing the design and implementation of the back-end level tasks. This sometimes led some of the clients to feel that not enough progress was being made. As a result, a few user-level features of the website were developed and demonstrated to the client in parallel with the development of the back-end tasks. In future offering of this course, some of the service-learning projects will focus on extending the projects completed in Fall-09.

6. Conclusion

We view service-learning as an extension of active-learning in many ways, with the service-client providing a human-face in the context of learning and problem-solving. This takes the student’s learning experiences to new heights. Creating a successful service-learning course is more demanding on the instructor and requires more advance planning than putting the principles of active learning into a course. It is nevertheless quite rewarding.

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7. References