Towards Using Problem-Based Learning in Teaching Computer Programming – Step 1: Developing Synchronized Multimedia Lectures Using Video and PowerPoint

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Introduction

This paper is motivated by the first author's desire to implement Problem-based learning or Project-based learning (PBL) in his computer programming classes. PBL is a popular teaching pedagogy that emphasis student's understanding of the course contents. The classroom and instructor's role in PBL environment are different from traditional teaching pedagogy. Instructor tends to be more of a facilitator than a lecturer in a PBL environment[1]. One of the advantages of PBL is that it relates the classroom experience to real life experience in a way that allows students to appreciate what they learn[1].

Preparation for teaching PBL courses is quite different. The course material should be presented in the form of problems or projects and enough references should be available for students. Classroom activities and group activities should also be planned and prepared to guide students in their learning.

In a typical PBL class, several problems or projects are used to cover the learning objectives of the class. Students are divided into groups and the problems are introduced to them. In a search for a solution to the problem, each group conducts research and consults references to understand the subject and solve the problem. The instructor's role is more of a facilitator than a lecturer. The learning objectives of the class are achieved through students' own search for a solution to the problems they are given.

The problems or projects a PBL environment plays an important role in achieving the learning objectives of the class. Group dynamics and instructor's ability to play the role of a facilitator contribute significantly to the success of the class.

There are different models of implementing PBL in a classroom[1]. One model is where no lectures are presented and students learn only through problems and projects. Another model is a hybrid model where the classroom time is divided between mini-lectures, group presentations and group work.

The first author is believes that PBL will have significant impact on first-year students who are learning computer programming. However, the author also believes that

traditional lectures are important for first-year students. A hybrid model is a suitable model in this environment especially when traditional lectures are made available to students as well.

Traditional lectures can be developed using digital video that is synchronized with power point. These lectures can be made available to students through the World Wide Web where they can view it before class and then use the class time to conduct PBL activities.

To prepare for teaching the computer programming sequence in a hybrid model, the first step was to prepare the lectures that will supplement classroom activity. The second step is to develop problems and projects to achieve the learning objectives of the class and the third step is to conduct a class and evaluate its effectiveness. This paper describes the work done in the first step and future papers will talk about the other steps.

Developing Synchronized Multimedia Lectures

There was no funding available In order to develop these lectures, so it had to be developed during the regular work load of full time faculty. It was decided that we will video tape the lectures during the academic year 2002-2003 and use it the following year with the hybrid PBL model.

Instructors use different tools to deliver their lectures ranging from traditional tools of using the blackboard, using overhead projectors to using presentation software such as MS PowerPoint. It is the author's believe that all these tools complement each other and they are all useful delivery tools. The author uses presentation software in addition to the blackboard to deliver his lectures.

The lectures are video taped in the classroom. It is then synchronized with the PowerPoint and made available for students using web-streaming. A digital camera with remote control was used to capture the lectures and Microsoft producer was used to capture the video and synchronize it with the power point presentation.

Originally, it would take about 3.5 hours for every 1 hour of lecture to produce the web-based version. For every one hour of lecture, an hour is needed to capture the video, an hour to synchronize with power point and one hour to publish. Then half an hour was the average used to publish the lecture to the streaming server and the web server. This was reduced to about 2.5 hours by the end of the quarter by reducing the number of the slides and minimizing the use of custom animation. This allowed the second author to record the timing of transition while capturing the lecture and thus reducing the time needed for synchronization.

Capturing the lecture also required the first author who was the lecturer to reduce his movement. Since he captured the lectures for himself sometimes, he was limited with the functionalities the remote control of the digital camera could provide. It was important to plan the movement during the lecture.

In the spring quarter of the 2003 academic year, the second author who was a senior student volunteered to help with the publishing process. The lectures were made available on the web site via blackboard management system one or two days after it was given.

A survey was conducted at the end of the class to get students feedback on the use of video lecture. Twenty students participated in the survey. 25% indicated that they watched the video lectures and 60% of them cited that they used it to reinforce the class lecture and 40% cited that they only watched the lectures they missed. 75% of the respondents indicated that they did not watch the video and 40% of them cited that they tried once to watch the video but got a server error so they did not try again. 33% cited that they come to class everyday and thus they do not need to watch the video lecture and 27% cited that they had no time to watch it.

When asked if the video lectures could have been of help to them, 80% of the students answered yes. 10% did not answer this question and 10% answered no. 70% of the students indicated that they prefer to have the video lectures available to them in future classes. The same percentage (70%) said that they think the video lectures can help them understand the course work better.

These answers show that students find having the lectures taped and made available through the web helpful and would assist them succeed in their class. This is of course provided that technical problems will be resolved. The majority of the students who did not watch the lectures indicated that the reason was technical problems they faced the first time they attempted to watch.

The last question in the survey was to explore their opinion on taking a class in the suggested model where the traditional lecture is made available on video and students watch it before the class and then the class time is dedicated to PBL activities. 50% of students answered yes and 50% answered no. Students have different opinions that can be seen from the following sample of their comments:

> *"A little bit of both, more hands on, but not so much watching videos"*
>
> *"Having the lecture in person is very interactive"*
>
> *"The problem solving part is the part that helps me learn it better than sitting through the lecture"*
>
> *"It is helpful to have interactive time during the lecture for detailed understanding and reinforcement"*

Several lectures were developed and the following table has a sample list of these lectures:

Title	URL
Review of C programming	http://www.citcd.uc.edu/~saidhm/cplus03/lecture2/
Review of C programming	http://www.citcd.uc.edu/~saidhm/cplus03/lecture3/
C++ - Polymorphism	http://www.citcd.uc.edu/~saidhm/cplusII/lecture5/
C++ - Templates	http://www.citcd.uc.edu/~saidhm/cplusII/lecture9/

In conclusion, the authors has prepared video lectures for some of the first year programming classes in preparation for using it to teach the same class using Problem-

Based Learning. These lectures can also serve as a learning module that can be exchanged or made available to instructors from other institutions since it is available on the web. Students' opinion is favoring having video lectures available to them as supplemental material but they are split on changing from the traditional lecture model to a different model.

References

1. Barbara Duch, Susan Groh and Deborah Allen, " The Power of Problem-Based Learning", Stylus Publishing, VA, 2001 (ISBN: 1-57922-037-1)

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