TIPS: A JiTT & PI Pedagogical Method with Handheld Computer as Mediating Tools

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Abstract

Technologies gradually take part in pedagogical progress, and some play a role as a mediating object. In this study, we construct a system to help teachers easily apply Peer Instruction (PI) and Just-in-Time Teaching (JiTT) pedagogical models. After having a pilot experiment which adopts PI and JiTT on general physics course with freshmen at the department of electrical engineering, we found two problems. One is pre-class assignments participation rate, and the other is in-class process issue. Therefore we designed a pedagogical method, named Think-Individually-then-Peer-Share (TIPS), to deal with these two problems.

1. Introduction

Technologies gradually take part in pedagogical progress, and some play a role as a mediating object [1]. In this study, we construct a system to help teachers easily apply Just-in-Time Teaching (JiTT) [2] and Peer Instruction (PI) [3] pedagogical methods. With the pedagogical application and environment, students could be immersed in learning and teacher could adapt his instruction to students' learning progress by using technologies as mediating tools.

After having a pilot experiment which adopts PI and JiTT on general physics course with freshmen at the department of electrical engineering, we found two problems. One is pre-class assignments participation rate, and the other is in-class process issue. Derived from Lyman's Think-Pair-Share (1981) [4] and with the responses from teacher and students, we design a pedagogical method, named Think-Individually-then-Peer-Share (TIPS), to deal with these two problems. The procedures and environment will be described thoroughly.

2. JiTT and PI

JiTT is a teaching and learning strategy combining web-based preparatory assignments with classroom activities that promote active learning [2]. The fundamental idea behind JiTT is to establish a feedback

loop between the Web and the classroom using a students' prior knowledge as part of the course structure.

The basic goal of PI is to exploit student interaction in class and to focus the students' attention on underlying concepts [3]. It involves students in course by interspersing brief mini-lectures with conceptual multiple-choice questions, called *ConcepTests*, designed to illustrate the basic principles of the material. The students think for one to two minutes about the question and commit to individual answers; if correct rate falls between 40%-80%, they spend two to three minutes discussing their answers in groups of three or four. After the discussion period, the instructor explains the answer.

3. Pilot experiment and two problems

The participants in this study were 99 freshmen (18 or 19 years old) in two classes of 47 and 52 students [5]. After reading assigned materials, students answered several multiple-choice questions on-line as pre-class assignments. The key point of pre-class assignments is not the correct rate, but the effort students pay. However, the result of the pilot study shows that most freshmen are not really form a good study habit after leaving high school, so it is hard to ask students to be well-prepared for their class. The performance of pre-class assignments was worse and worse. To reform this situation, we consider that team spirit not only is important in class, but also has been created and sustained out of class. We raise self-assessment and peer-assessment to pre-class assignments in order to assist students in reflection and self-regulation.

The other problem is that students could not make progress in their own pace while *ConcepTest*. In class, the teacher lectured the outline and students processed *ConcepTest* with remote controllers in our pilot experiment. The original flow of *ConcepTest* is whole class discuss the same question with his neighbors [3]; therefore, when one student and his neighbors reach a common consensus quickly, they still need to wait for

others. That gives a chance to students to do some other conversation instead of focusing on class. Hence, we adopt *Mobile Computer Supported Collaborative Learning (MCSCCL)* system [6] with wirelessly networked Handheld Computers as mediating tools to support *ConcepTest*, which promotes student collaboration and co-construction without losing face-to-face contact. The description of our solution is provided in the following section.

4. Pedagogical method & system of TIPS

In this paper, the TIPS pedagogical method and system are proposed to be applied in pre-class and in-class learning environments.

There are three pre-class phases. Students work on a Web-based system to transfer data between each other and the teacher. First, all students have to read assigned materials and commit individual answers of several related open-end questions with grading themselves according to a criterion on-line. Second, after students commit individual answers, students are arranged in groups of six. Each student can see other five students' answers without names, and anonymously grade their answers according to a criterion on-line. Third, after mutual assessment, students would be told who are in the same group. Students can always form a study group and discuss assigned questions and grades with each other according to the same self-assessment criterion. Each group has to commit group answers on-line. Later, the teacher comments and corrects these groups' final answers in class.

There are also three in-class phases. First, the teacher discusses the pre-class groups' final answer and lectures key concepts which are adjusted according to these final answers. Second, each 6-member group is divided into two 3-member small groups. Each student with a handheld computer should answer a set of multiple-choice *ConcepTest* questions collaboratively. Each group could answer in their own pace. Each *ConcepTest* question presents three to five options, of which the students must select. Given that the goal of the phase is to ask students formulate their own answer, the group is not allowed to advance to the next question without answering the current question correctly. If the question is not answered correctly, the application "marks" and disables the alternative that has been incorrectly selected. The students are then obliged to select a new alternative from the remaining ones. In the event of several errors, the only remaining enabled choice will be the correct answer. While answering the questions, the members of each group should debate and then come to an agreement on the alternative that their group will select. If the members do not agree on an answer, and enter different

responses on their individual handheld computers, the application requests that they come to an agreement and returns to the same multiple-choice question. At third phase, the teacher leads whole class to discuss the questions one by one. Generally a brief explanation suffices because nearly all students are persuaded of the correct answer in the group discussion.

At the pre-class phase, students access the assignment on the Web-based system. Students can use their own Desktop computers, Tablet PCs or notebooks in any place such as dormitory, classroom, home or library to access the Web server to complete these assignments before class. And at the in-class phase, the students use their mobile devices such as Tablet PCs or PDAs to process the mobile collaborative learning activity through the wireless network to access the activity server in the classroom. The students can work face-to-face in group without mobility restrictions, and take advantage of the information supplied by the net. It is critical to transfer information effectively from the handheld network to the social network.

5. Summary and future works

In this paper, TIPS pedagogical method is proposed and TIPS system plays the role as a tool, which means the computer is a mediating object that is neither in control nor the object to be controlled. Teachers, activities and teams of students are the loci of control. In the near future, we will observe its qualitative and quantitative impact on learning.

6. References

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