Title	Use IT to present scenarios for problem-based learning
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USE IT TO PRESENT SCENARIOS FOR PROBLEM-BASED LEARNING

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Abstract: Effective Problem-Based Learning (PBL) begins with problems that can sustain students' interest and motivate them to probe for deeper understanding of the concepts being introduced. How can IT be used in presenting PBL scenarios in such a way that students' interests may be aroused from the very beginning of their PBL experience? This paper discusses how pre-service teachers are helped to develop skills necessary for using multimedia in problem-based learning. Trainee teachers taking the module Instructional Technology at National Institute of Education learn to use PowerPoint to produce "stimuli" that may be used to present PBL scenarios. Through the experience trainee teachers become familiar with PBL approach and at the same time learn to use make full use of the multimedia features of PowerPoint to enhance students' learning experience.

Introduction

Problem-based learning (PBL) offers an alternative instructional approach to help motivate students to engage in authentic problem solving and to develop skills required for lifelong independent learning. Since its conception in North American medical school a few decades ago, PBL has been adopted for the preparation of professionals in diverse fields such as engineering, law and business. PBL has yet to become a popular instructional approach in lower level of education, i.e. K-12, as compared in the preparation of professionals. Nonetheless, increasing number of studies have been published in recent years on PBL programs at K-12 level.

Changing educational landscape, diffusion of alternative instructional approaches including PBL and of instructional technologies, present challenges to teacher education programs. As the only teacher training institution in Singapore, National Institute of Education (NIE) strives to equip newly graduating teachers with sound pedagogy that may enhance student learning. At a time when computers are widely available in schools, we also make every effort to prepare trainee teachers for technology integration in instructional planning and activities. We believe that understanding of pedagogy is an important step towards successful technology integration.

At the Instructional Technology module at NIE, trainee teachers are helped to develop skills necessary for integrating IT into teaching. They are also introduced to various unconventional instructional approaches. Using the newly acquired knowledge and skills, trainee teachers learn to use PowerPoint to produce "stimuli" that may be used to present PBL scenarios. The rational is that trainee teachers may become familiar with PBL approach and at the same time learn to use make full use of the multimedia features of PowerPoint to enhance students' learning experience.

Problem Based Learning

Until recently, it was believed that the brain has different compartments, each performing a distinctive function (one for reasoning, another for feeling, etc.) and that little communication took place among them (Beane, 1995). Such a belief was shaken by the discoveries of recent brain research. Gardner (1983) argues that all the seven intelligences (linguistic, logical-mathematical, spatial, bodily kinesthetic, musical, interpersonal, and interpersonal) function interactively for learning and problem-solving. Our brain cannot easily learn things that are not logical and have no meaning. Instead, the natural tendency of our brain is to integrate information.

Critics of the current curricula contend that school curricula force students into a constant continuum of skills, with no time to absorb or assimilate (Lowery, 1991). Different from traditional direct instruction, PBL begins with an authentic problem without any prior preparation by students (Boud, 1985). Problems presented in PBL are normally ill-structured and have more than one single solution. Usually undertaken in a small group, students identify areas of learning for study. Knowledge and skills acquired in this way are applied back to the problem. The final reflective phase provides opportunity to summarize what has been learned, and to integrate it with the student's prior knowledge.

Findings in the existing studies suggest that PBL helps students to take on an active role in their educational experiences as they are actively involved in the learning process and they learn in the context in which knowledge is to be used (Boud & Feletti, 1997). In PBL, students are encouraged to develop the skill of transferring knowledge into new domains, a skill that they can carry with them throughout their lifetimes (Brine & Shannon, 1994). As they are empowered with the responsibility of managing a largely self-directed learning process, students are better equipped to take on the responsibilities of mature professional life (Brine & Shannon, 1994).

Research studies also suggest that PBL provide opportunities for students to learn how to present and defend their plans (Delafuente, Munyer, Angaran & Doering, 1994), and it enhances students' interpersonal skills, such as working with group dynamic (Bernstein, Tipping, Bercovitz & Skinner, 1995; Pincus, 1995; Vernon, 1995).

Use MicroLESSONs™ to Present Problem Scenarios

At National Institute of Education, all pre-service teachers are required to take Instructional Technology, a course that prepares pre-service teachers on necessary skills to integrate IT into instructions. One component of the module is to help trainee teachers to develop a multimedia product for teaching, what we call MicroLESSONs™. Early MicroLESSONs™ were largely teacher-center teaching aids for the purpose of direct instruction. Starting from 1998, we started to guild trainee teachers to produce more learner-centered instructional materials. However, instructional approaches employed in these materials were still confined to drill and practice and tutorials. At a time when schools are actively exploring alternative approaches to teaching and learning, this is obviously not enough.

We believe that students preparing to be primary and secondary school teachers should be exposed to unconventional instructional approaches including PBL. We believe that understanding of pedagogy is an important step towards successful

technology integration. In 1999, we introduced the second generation MicroLESSONs™ (Wong & Divaharan, 2000). A major difference between the first and second generation MicroLESSONs™ is that the latter lays more emphasis on teaching materials employing alternative instructional approaches, such as resource-based approach, case-based approach, simulation-based approach and problem-based learning. In other words, we adopted situated cognition as an epistemology (Brown, Collins & Duguid, 1989) for our instruction and tried to design projects in the same orientation.

Design of multimedia teaching materials based on PBL principles present particular challenges. Due to time constraints, we cannot possibly address all aspects of PBL in MicroLESSONs™. Therefore, we decide to concentrate on using multimedia to present problem scenarios.

Effective PBL begins with problems that can sustain students' interest as they attempt to reach a viable solution and motivate them to probe for deeper understanding of the concepts being studied. Research shows that when problems are engaging, it is more likely for higher levels of comprehension and skill development to occur (Albanese & Mitchell, 1993). Because most problem-based learning solutions take an extended period of time to reach resolution, it is important to maintain motivation, which can be enhanced when students understand the relevance of their class work (Ostwald, Chen, Varnam & McGeorge, 1992). Relevant problems may also help improve the probability that students will transfer their acquired skills and knowledge to life outside the classroom, and enhance their ability to solve real world problems.

Research studies document a variety of ways that computers may be used to facilitate and enrich the experience of PBL (Mackenzie, Kitto, Griffiths, Bauer & Pesek, 1997; Ronteltap & Eurelings, 1997). According to Hoffman and Ritchie (1997), the key benefits of multimedia in PBL would include fidelity, representational richness, timeliness, individualization and efficiency. Multimedia presentation tools offer opportunities to present rich, multifaceted learning experiences that may stimulate students' senses and motivations.

Since the second generation MicroLESSONs™ was introduced in January 2000, our trainee teachers produced a few dozen instructional materials on PBL. Users of these MicroLESSONs™ are invited to play the role of a problem solver in a particular situation presented. Each problem begins with an activation task in which primary and secondary school students view a brief statement depicted in graphics/animations and texts. A series of planning tasks follows and students are encouraged to evaluate alternative solutions. Along with MicroLESSONs™, trainee teachers prepare tasks to encourage reflection and integration of what has been learned.

Figures 1 and 2 show one example of MicroLESSONs™ on PBL. The courseware titled Life after War is targeted at Primary 4 students for Social Studies. Students are

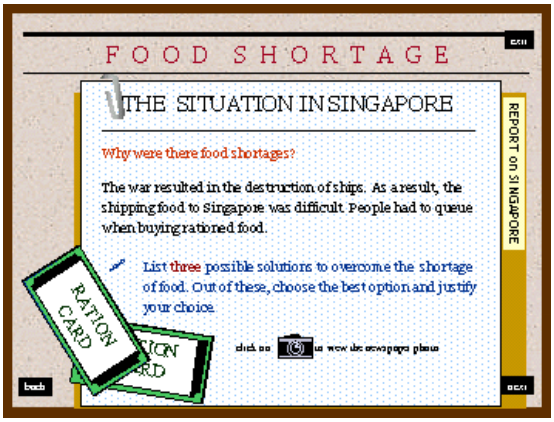
asked to act as a government officer to solve the problems faced by Singaporeans during the period of 1945-1954. A series of problems are presented, such as shortage of food and housing and unemployment. Students are asked to choose the best solution to solve the problems presented and justify their choices.

Figure 1: Life after war

Figure 2: Problems to be solved

Grow (1991) suggests that in order to help students move from dependence to independence in PBL, teachers need to adopt new roles which will enable learners to advance through a number of stages leading eventually to full independence. In making multimedia, trainee teachers learn to scaffold and to provide tools for students to search for problem solutions. In MicroLESSONs™ designed for primary school students such as Life after War, heavy scaffolding is offered to students for them to work on problems presented. Figure 3 gives one example on how students are guided in looking for problem solutions.

Figure 3: Possible solutions



To relieve trainee teachers from time spent on design issues, we provide templates that trainee teacher may use. Such templates also help to provide a consistent interface throughout the instructional materials. Such an approach is well received by trainee teachers.

Conclusion

Traditional memorization of facts required of students made many students to lose the ability to "simply wonder about something" (Reithlingshoefer, 1992), and to have difficulties with self-directed learning. PBL offers an alternative avenue to teaching and learning. PBL requires more time of the student's time and expects them to be responsible and independent learners. The role of students in problem-based learning differs from that in the traditional assumptions of students. Similarly, teachers are no longer the main disseminators of knowledge, but facilitators to guide students in searching information.

Using MicroLESSONs™ to present problem scenarios provides an example for practice worthy of emulation. Our experience indicates that IT may be used to enhance problem presentation in PBL. Synergistic combinations of effective instructional approaches with IT may contribute to the improvement in preparation of future teachers to use IT for teaching. Most importantly, through the experience our trainee teachers learn to use information technology to promote a new learning mode, a new learning culture where teachers are facilitators and students are independent learners.

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