PRESERVICE TEACHERS USE IT TO PRESENT SCENARIOS FOR PROBLEM-BASED LEARNING

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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 information technology (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 our experience of helping preservice teachers to develop skills necessary for producing multimedia-learning objects that may be used in PBL. Trainee teachers taking the Instructional Technology module at the National Institute of Education, Singapore, learned to use PowerPoint to produce "stimuli" that could be used to present PBL scenarios. The experience provided opportunities for trainee teachers to become fluent in using the multimedia features of PowerPoint and at the same time get familiar with PBL as an instructional approach .

INTRODUCTION

Changing educational landscape, educational reforms and diffusion of instructional technologies present challenges to teacher education programs. As the only teacher training institution in Singapore, the National Institute of Education (NIE) strives to meet new challenges by equipping 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. This paper describes how one of our modules helps preservice teachers to combine their newly acquired IT skills with pedagogy in preparing scenarios for Problem-Based Learning (PBL).

Instructional Technology is one of the compulsory courses for all preservice teachers enrolled at the National Institute of Education. The module helps trainee teachers to develop skills necessary for integrating information technology (IT) into teaching. The philosophy that underpins this module is that preservice teachers should become independent learners and reflective practitioners. Their ideas and thinking should be challenged in ways that provoke them to reconsider and better articulate their understanding of IT and its use in teaching and learning. Obviously, this philosophy is heavily influenced by constructivism. Throughout

our module, we emphasize that trainee teachers should create their own new understanding, based on interaction of what they have already known and experienced (in teaching, if any), and the ideas with which they come into contact.

Compared with conventional teaching, constructivist teaching typically involves more student-centred learning experiences and activities with concrete materials and in solving realistic problems (Shuell, 1996). This is new to most of our trainee teachers as they are more used to the traditional role of a teacher which is to impart knowledge to students. To change the situation, our module emphasizes collaborative work, peer tutoring and learning. Most of our assignments are completed in groups. Working together, trainee teachers explore ways of integrating IT into various subject areas. The rationale is that experience will help trainee teachers familiarize with strategies involved in student-centred learning and such knowledge may help them to supervise their students' work when they become full-fledged teachers.

We believe that effective use of IT has to be linked to adaptation of new teaching/learning strategies. It would be difficult for teachers to take full advantage of IT if lessons are delivered in traditional ways. Therefore, our module introduces trainee teachers to a diversity of teaching strategies and techniques related to the use of these strategies. We believe that understanding of pedagogy is an important step towards successful technology integration. Starting from January 2000, we encourage trainee teachers to use the newly acquired IT skills and knowledge on pedagogy to produce "stimuli" that may be used to present PBL scenarios. Through the experience, trainee teachers learned to use make good use of the multimedia features of PowerPoint and at the same time get familiar with the PBL approach.

PROBLEM-BASED LEARNING

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 schools 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 the lower levels of education, that is, K-12, as compared with the preparation of professionals. Nonetheless, an increasing number of studies have been published in recent years on PBL programs at K-12 level.

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 opportunities to summarize what has been learned, and to integrate it with the students' prior knowledge.

Findings in 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, 1991). 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 provides opportunities for students to

learn how to present and defend their plans (Delafuente, Munyer, Angaran & Doering, 1994) and enhances students' interpersonal skills, such as working with group dynamics (Bernstein, Tipping, Bercovitz & Skinner, 1995; Pincus, 1995; Vernon, 1995).

PBL has only recently found its way into Singapore classrooms. Although there are a number of studies on the implementation of PBL in government schools (Hu et al., 1999), the impact of PBL on student learning and development needs to be investigated.

USE OF MICROLESSONS™ TO PRESENT PROBLEM SCENARIOS

One of the requirements for trainee teachers to complete our module is to produce a multimedia object for teaching (what we call MicroLESSONs™) using Microsoft PowerPoint. Early MicroLESSONs™ were largely teacher-centred teaching aids for the purpose of direct instruction. Starting from 1999, our trainee teachers started to produce more learner-centred 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. We believe that understanding of pedagogy is an important step towards successful technology integration. In 2000, 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, PBL, etc. 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 could not possibly address all aspects of PBL in MicroLESSONs™. Therefore, we decided 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). Relevancy of 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 Ritchie, Norris and Chestnutt (1995), the key benefits of multimedia in PBL would include fidelity, representational richness, timeliness,

individualization and efficiency. Multimedia presentation tools offer opportunities to present rich, multi-faceted learning experiences that may stimulate students' senses and motivations.

For the trainee teachers who chose to present PBL scenarios for their MicroLESSONs™ projects, the first challenge was to find appropriate problems. To help trainee teachers understand the concept underlying PBL and methods, we presented examples and discussed with trainee teachers during tutorial time. Problem-based learning engages students in meaningful learning through structuring solutions to real life and contextualized problems. This presents a contrast to traditional classroom situations where teachers lecture, students are asked to memorize materials for tests and they use little of what they memorize. As the concept was foreign to many of our trainees, they had difficulties at deciding what to tell pupils and what should not be told. Discussions with tutors and peers, sharing and reflection of their limited classroom experience helped trainee teachers to understand the rationale of PBL and respective roles played by teachers and students in PBL. Such an understanding helped them to come up with relevant problem scenarios for their MicroLESSONs™. Problems presented by trainee teachers included water conservation, healthy diet, etc.

The second challenge that our trainee teachers encountered in making MicroLESSONs™ was interface design. Some trainee teachers became so absorbed in choosing problem scenarios that they forgot powerful features that multimedia could have in stimulating students' different senses for learning. One typical problem was that interface design tended to be text-based and features of audio and animation were not utilized. We realized that scaffolding was necessary. Time was then allocated to tutorials where trainee teachers could discuss their ideas and design with their tutors. One of the first questions that always came up in these consultation sessions was "Can you achieve the same objective using paper and pencil?" If the answer was "yes", the next question would be "Then, why should you bother using PowerPoint?' Questions such as these prompted trainee teachers to rethink their designs and sometimes even problems.

To relieve trainee teachers from time spent on design issues, we provided interface design templates that trainee teachers could use in their MicroLESSONs™. There were altogether 50 templates for trainee teachers to choose from. Such templates helped to provide a consistent interface throughout the instructional materials, and were well received by trainee teachers. Trainee teachers were constantly reminded of fidelity and representational richness that may be brought about by PowerPoint. With this kind of push, trainee teachers started to think deeper about technical aspects. As a result, use of media expanded from simple texts to digital photographs, video clips, audio recording, web links, etc. The variety of technologies employed helped to make problems presented closer to real life situations. For instance, one project entitled Jack's Problem (targeted at lower primary school students) portrayed a boy seeking help about his weight problem. His picture was shown on the first page. Users could hear him talking and looking at his favorite junk food presented in digital photographs.

Since the second generation MicroLESSONs™ were introduced in January 2000, our trainee teachers have produced a dozen MicroLESSONs™ on PBL. One common feature with these MicroLESSONs™ is that users 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. Figures 1 and 2 show one example of MicroLESSONs™ on PBL. The MicroLESSONs™ entitled Life after War is targeted at Primary 4 students for Social Studies. Students are asked to act as government officers to solve the problems faced by Singaporeans during the

period of 1945-1954. A series of problems are presented such as shortage of food, housing and unemployment via old photograph and sound effects.

Figure1. Life After War

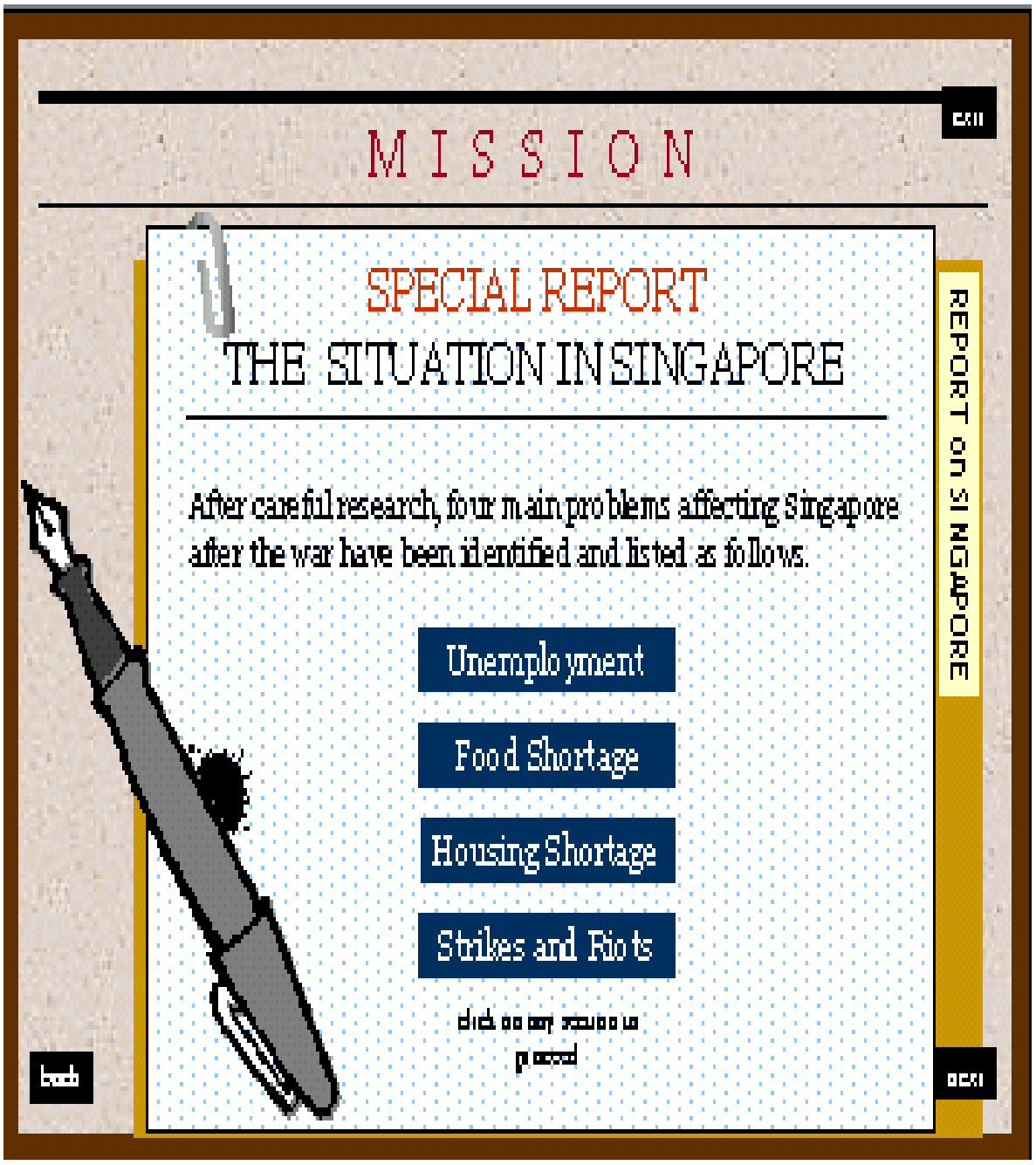

Figure 2. Problems To Be Solved

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 addition to presenting problem scenarios, some trainee teachers went a step further by offering scaffolding and tools for students to search for problem solutions. This was particularly true with MicroLESSONs™ designed for primary school students, such as Life after War. Along with MicroLESSONs™, some trainee teachers also prepared tasks and activity sheets to encourage reflection and integration of what has been learned. Figure 3 gives one example on how students are offered guidance in looking for problem solutions. Students are asked to evaluate alternative

solutions given, choose the best solution to solve the problems presented and justify their choices.

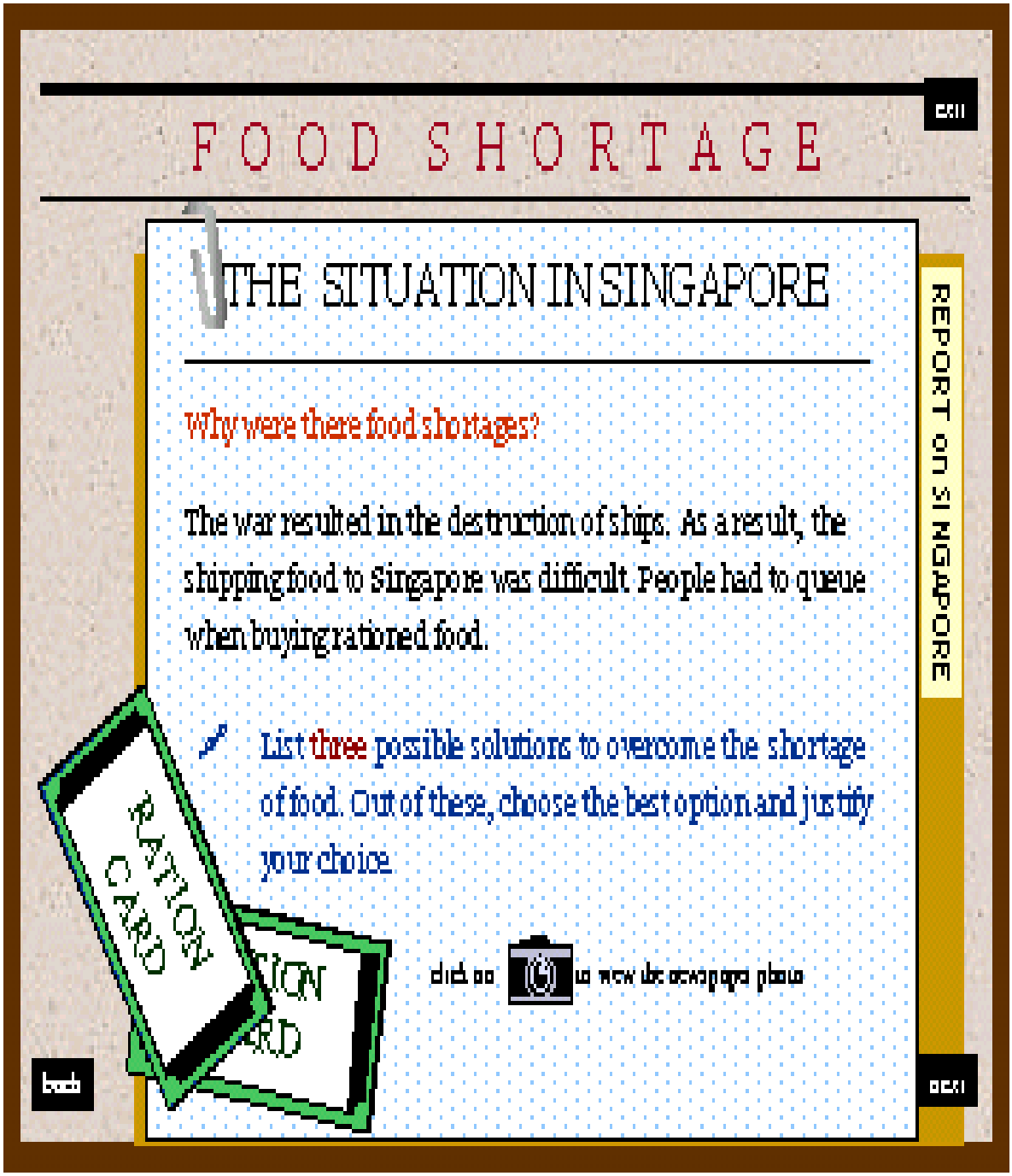

Figure 3. Possible Solutions

CONCLUSION

Traditional memorization of facts required of students make many students 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. Our experience of using MicroLESSONs™ to present problem scenarios provides an example for practice

worthy of emulation. Although we do not have any hard evidence on how MicroLESSONs™ will help primary or secondary students in their learning, the preliminary findings on trainee teachers' feedback are encouraging. Though somewhat apprehensive to begin with, trainee teachers generally found the process of making MicroLESSONs™ and discussing problem scenarios with tutors valuable as a learning experience. The opportunities provided for designing and developing multimedia objects for teaching made trainee teachers more comfortable and confident in using IT in preparing lessons. Working with peers proved to be a useful source of ideas and assistance when technical problems occurred. The opportunities provided for exploring PBL opened a window for trainee teachers to consider the value of these methods and the possibilities of using them in their teaching. Most importantly, our preservice teachers preparing to teach in primary and secondary schools learned that teachers do not necessarily have to be main disseminators of knowledge, but facilitators to guide learners in searching information and learning new knowledge.

Our experience showed the importance of extra preparation necessary to manage MicroLESSONs™ projects. We realized that once trainee teachers understood the concept of these new approaches such as PBL and chose problem scenarios, the challenge would then be how to guide them to integrate powerful features of multimedia into the problem presentation. Unlike usual teacher-centred instruction, multimedia presentation requires a set of different protocols. It is necessary to create a design that takes into account students' perspectives, their media viewing habits and their ability in understanding visuals, and more importantly, one that extends an invitation to young learners to probe into the problems presented and to search for solutions.

Though based on trainee teachers' descriptive feedback on MicroLESSONs™, our results are sufficiently encouraging to warrant further refinements already put in place for improving MicroLESSONs™. From the feedback of our trainee teachers, it is obvious that synergistic combinations of effective instructional approaches with IT may contribute to the improvement in preparation of future teachers. One trainee teacher commented, "learning to do the micro lessons was also interesting and I have learnt a lot." Another said, "I didn't know that IT can be integrated into classroom instruction in so many different ways, for example, the use of CD-ROM, micro lesson, online discussion, and the different teaching strategies, not just only using power point presentation." Still another said, "I have learnt that IT can be infused into school. However, …it has to be infused with a correct mind frame, that is, involving more students in the learning process." It is obvious that bringing together the technology of multimedia and unconventional teaching approaches promises to make available to trainee teachers both a rich source of learning to use information technology to promote a new learning mode and a new learning culture where teachers are facilitators and students are independent learners. Our next step will be to study the pedagogic promise that these MicroLESSONs™ will improve teaching and ultimately benefit pupils.

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