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# IT Integration and Online Learning in the Singapore Schools

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This article attempts to review technology integration efforts in Singapore schools and at the National Institute of Education (NIE, Singapore). The Singapore Ministry of Education (MOE) launched the 'Master plan for IT in

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Education' in 1997 and has since invested about US\$1 billion to establish IT infrastructure, equipment, and resources in all Singapore schools. The aim is to enhance the teaching and learning milieu through IT-based instruction. As a result of this master plan, the school curriculum was gradually changed and IT became integrated into all subject areas. In order to practically implement the IT Master Plan in education, teachers need to be competent in the use of IT for instruction. It is within this context that the NIE's approach to preservice teacher training in the use of IT in education is being introduced.

### **IT Integration and Online Learning Projects**

The focus over the last few years in the IT Master Plan has been on: (1) building up the physical and technological infrastructure in the schools; (2) fostering teacher development in the use of IT; (3) building up of content and learning resources; (4) encouraging innovation, research, and development; (5) infusing curriculum and assessment issues in and through IT; and, finally, (6) establishing international relations and linkages with regard to IT. To some extent, particularly in the schools that had a head start with IT integration, these goals have been achieved and efforts are underway to further consider how IT and online environments can facilitate *learning processes* in the context of a more responsive and dynamic curriculum.

Under the auspices of the IT Master Plan, schools in Singapore over the last five years have been empowered with flexibility in experimentation with online learning. Pioneer schools in the implementation of IT have piloted innovative ideas to the curriculum. For example, some schools have even tried ideas where students do not need to come to school and where learning could take place at home. Such implementations have not been widespread but have been adopted in terms of short durations. Other schools have adopted IT and online learning for communication and collaboration, particularly in facilitating the understanding of literacy. Project work has also been an emphasis, and some schools are capitalizing on the technology to enhance and integrate interdisciplinary or multi-disciplinary content—making learning of subject areas more meaningful for the learner. The institutes of higher education have also been pioneering newer technologies, such as wireless infrastructures, and some of these concepts have transformed more traditional setups. Schools are also gradually finding ways to use technology to enhance their traditional ways of working in the classrooms and beyond. Students could be actively engaged in their projects in the corridors, canteens (cyber-cafés), and out-of-classroom settings.

In the next section, we document some examples of online learning in schools under four broad categories:

cyber conferencing, e-learning service providers, e-publication, and wireless technology.

### **Cyber Conferencing**

In the *Raffles Girls School* (RGS) (Raffles Girls School, 2000), an equivalent of a high school in the US, a Cyber Learning Center was set up. The center boasts state-of-the-art videoconferencing equipment, which allows students to participate in interactive lessons through synchronous or asynchronous conferencing. Lessons can also be recorded and made available through video-on-demand to other users in Singapore, making use of the broadband facility. RGS is also experimenting with a computer-supported collaborative learning system, known as *Knowledge Forum* (Learning in Motion, 2002). This collaborative learning program provides a platform for students to engage in collaborative work and discussion, and at the same time, records the development of ideas and tracks student's contribution for assessment purposes.

In 1997, as another example, 17 primary schools and 17 secondary schools participated in the Konet Plan project, a global environment project initiated by Japan (Ministry of Education, 2000a). In this joint research project, students collected experiment data, such as the density of nitrogen oxide in the air, and forwarded the findings to the coordinating site. The students subsequently engaged in online conferencing and discussions.

In another instance of international collaboration, 43 pupils in a Singapore primary school took part in video-conferencing with pupils from Chile (Ministry of Education, 2000b). The project, held in 1998, provided opportunities for students in both countries to discuss issues with their counterparts who are situated in different cultural backgrounds.

### **E-Learning Service Providers**

In the broadest sense, e-learning is learning administered via any electronic medium—CD-ROM, video, or Internet. In practice, the dominance of Internet technology makes it the medium of choice among the electronic media. By e-learning, we mean the "Internet-enabled learning that encompasses training, education, just-in-time information, and communication" (Cisco Systems, 2001). Increasingly, Singapore schools are subscribing to e-learning service providers to cater to the e-learning requirements of the schools.

A number of companies are providing the schools with e-learning services, including *AsknLearn.com* (AsknLearn.com, 2002) and *Ednovation* (Ednovation, 2002). These companies provide a range of services to the schools beyond the provision of a learning management system. Some additional services include curriculum-specific contents, prepared lessons, learning objects, lesson builders, online testing mechanisms,

online communication environments, project management systems, and online collaboration systems. Some companies also work with school teachers to design and develop interactive learning objects.

## E-Publication

Utilizing the Web for e-publication, two primary schools in Singapore collaborated with two primary schools in the UK in the "Operation Ocean Wave" project (Ministry of Education, 2000c). In this project, the students in each school focused on aspects of a British warship—*HMS Illustrious*—which was heading to Hong Kong for the official handover (to China) ceremony en route Singapore. Using a "traveling buddies" concept, their reports and essays were exchanged via e-mail and published on a Website hosted by the British Council.

Another example of the e-publication approach was demonstrated by a primary school that hosted its own School Electronic Magazine. Through e-mail, students reported interesting things that they encountered, shared their favorite Internet sites, provided their opinions or reactions, and showcased their best essays written in a class setting. A story continuation game was also set up. In this game, the first paragraph of a story was given and students were able to send in their contribution as the next paragraph. The best 'continuation paragraphs' were chosen weekly.

## Wireless Technology

Some of the schools in Singapore are also moving away from computer labs to decentralized learning centers and corners where students can engage in their work collaboratively using wireless technologies. In a case example, PDAs are first used as the main tool for reflection of an English language lesson and subsequently as a collaboration device where student compile all notes by transmitting their reflections to one another in a group. In yet another school, students are carrying data-loggers out into the field and capturing data and subsequently comparing it with information on the World Wide Web via the Internet. Data captured by the students can also be uploaded onto the Net. Various tools were used for further manipulation, analysis, and visualization.

The trends in online learning as illustrated in the above examples are similar to the kinds of developments in the Asia-Pacific regions (as described in this special issue) and the US. Increasingly, the World Wide Web is an accepted platform for learning in the schools, and not just in industry. Communication via networked technologies is extending learning beyond the local classroom to the international arena.

Although there are many such online learning efforts occurring in the local K-12 schools, many educators are questioning the effectiveness of such learning

experiences as compared with the more traditional forms of classroom instruction. The issues of whether online learning environments are providing a more effective means of learning is recognized as a difficult question to answer, and efforts are underway in the IT MasterPlan II to tackle some of these concerns.

In the next section, we expand on the notion of IT and online learning by framing a preliminary identification of the kinds of IT tools that can be integrated within the online learning framework. We describe our thoughts within the case example of the National Institute of Education.

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## Online Learning at the National Institute of Education (NIE)

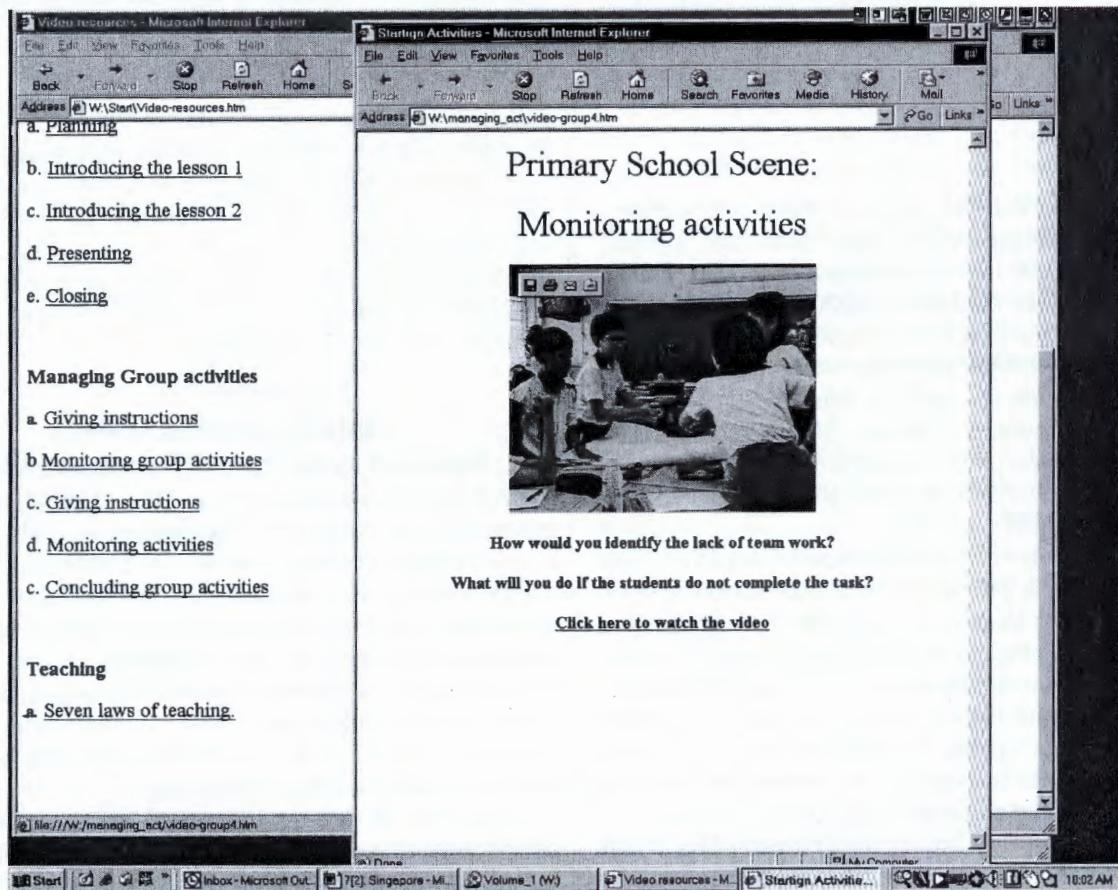
The National Institute of Education (NIE) is the sole teacher-training institute in Singapore. As a philosophy of the institute, IT integration through online learning is not perceived as a stand-alone initiative but rather as an integral part of the curriculum, instruction, and assessment process. We note at this point that we are not casting online learning in terms of mere information delivery, but rather as a mechanism for problem-centered activities through which our trainee-teachers can be engaged actively in learning.

In particular, IT is an integral part of the NIE's philosophy of active, problem-focused teaching and learning processes, where content is applied to authentic practices—thus the need for integrated content areas. An emphasis is also targeted towards an assessment where the processes of thinking and communication are emphasized. Problem-based learning (PBL) is one pedagogical approach that adopts problems and real-life cases as a starting point in instruction at the NIE. Thus, pedagogy is a focus, rather than technology *per se*.

A gradual redesign of curriculum is being looked into in order to more effectively employ IT tools and online learning environments in PBL contexts throughout the modules at the NIE. Problem-based learning starts primarily with a focus on problems, that is, real-life problems and activities, rather than intense disciplinary knowledge (Boud, 1995; Savery & Duffy, 1995). The approach attempts to move learners towards the acquisition of knowledge and skills through a staged sequence (serving as a scaffolding process) of problems presented in context, together with associated learning materials and support from necessary sources (e.g., teachers and experts)..

Current forms of technology, for example, Web-based tools, have been adopted in relation to curriculum and pedagogy integration. The following are ways in which IT tools are used at the NIE:

1. **IT as an information resource**, for example, Web-resources. As an information resource, IT can be used as a tool to access relevant information and



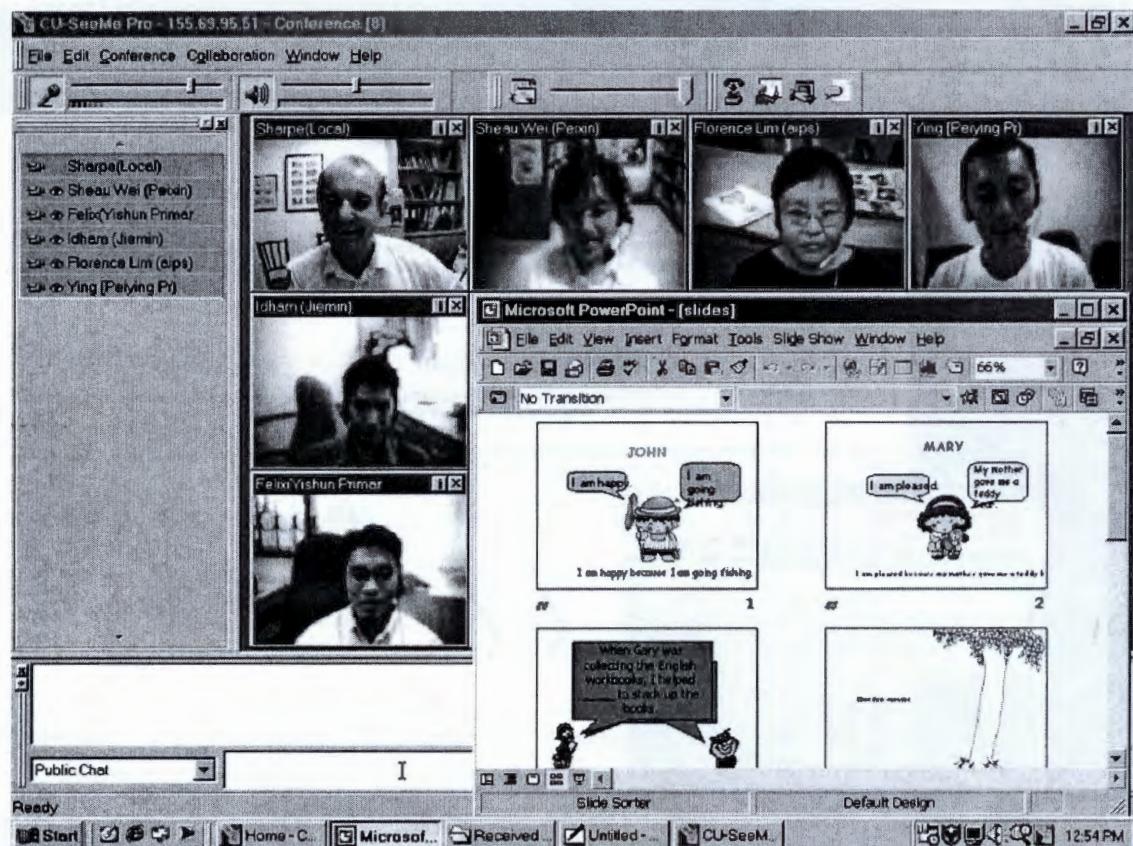
**Figure 1.** Classroom management module with online component.

resources when engaged in project work and other forms of problem-oriented activities. However, students need to develop information literacy skills and the skill of validating the kinds of information found on the Web. Information resources should be provided in a just-in-time and learner-selectable way. An example of such a mechanism occurs when our trainee-teachers make use of video-footage (posted on CD-ROMs or on the Web) of real-life classroom misbehaviors and engage in an online discussion over these issues (see Figure 1). Within this module, trainee-teachers access relevant information resources, watch realistic footages of what is happening in classrooms, and engage in discussions with supervisors and peers when they are attached to the schools

**2. IT as a communicative tool**, for example, discussion forums and other collaborative tools such as *Knowledge Forum* (see Scardamalia & Bereiter, 1994). As a communication tool, students are able to engage in a constructive dialog with other peers and with experts on issues of particular concern. Scardamalia

and Bereiter (1994) conceive such a discourse as knowledge building. Technology has been used to facilitate the process of tele-mentoring between real practitioners and trainee-teachers. Multi-point desktop video conferencing (MDVC, see Figure 2) is one such system that allows the various parties from the institute to communicate with one another and also with inservice teachers in the schools. Due to the logistical convenience such an environment affords, dialog between various parties (both within and outside of the institute) has been improved.

**3. IT as a visualization tool**, for example, the use of simulations such as Java applets. Through simulating principles and concepts through animation, IT tools of such nature can foster understanding of difficult to visualize concepts. See Figure 3 for an example of a physical sports module on the concept of biomechanics. Other examples include visualizing chemical or molecular structures and simulations that can be controlled via the manipulation of variables in order to observe certain phenomena.



**Figure 2.** Multi-point desktop video conferencing.

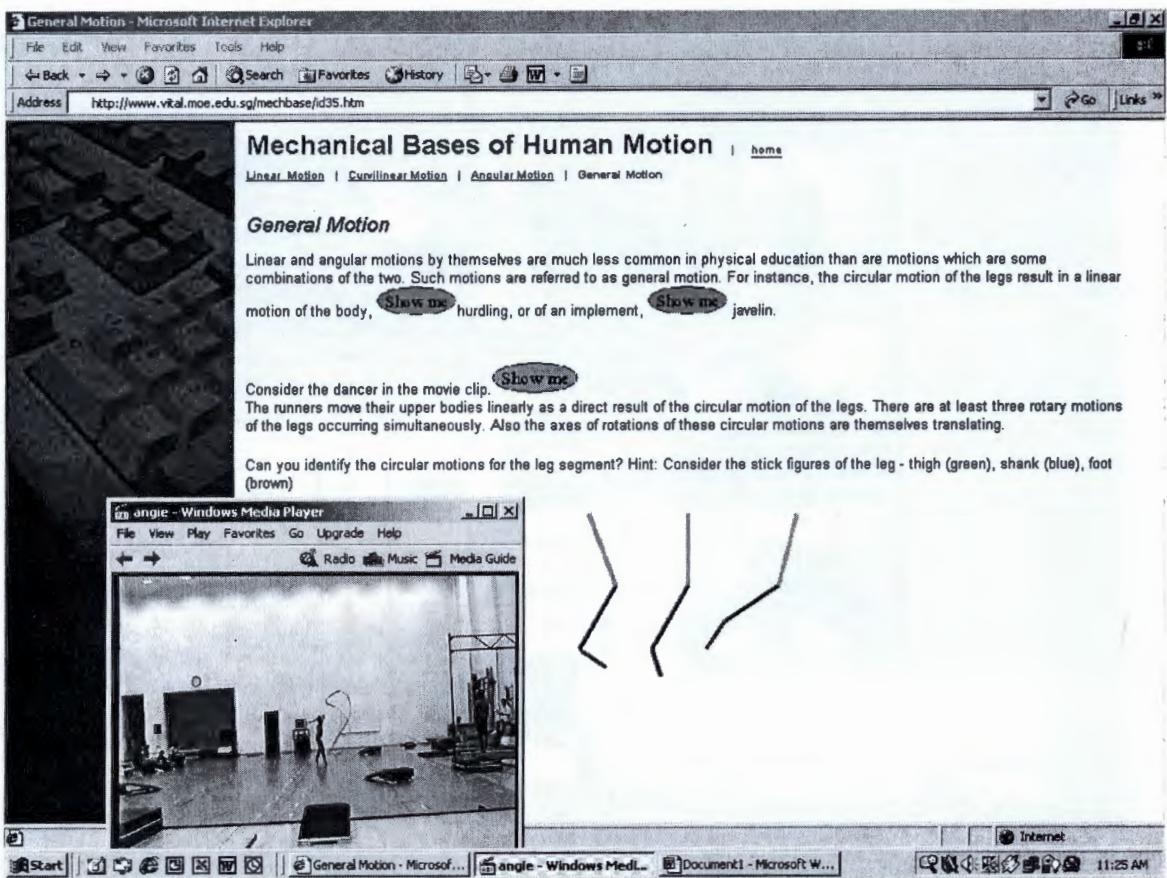
4. **IT as a data management tool**, for example, MCQ or Survey questions on Blackboard (Web-based management system) with all results automatically tallied. Data management tools are taught to trainee-teachers for various tasks, including item banking, item analysis, item calibration, test construction, test administration, test scoring and test reporting, and their applications for school-based testing.

5. **IT as a constructive tool**. As an example, trainee-teachers were required to design a Web-based project task using the PBL framework. To make learning experiences more authentic, experienced teachers from the schools are also invited to share the successful experiences, for example, on the *WebQuest* project (see San Diego State University, 1998) approaches from their K-12 schools. Trainee-teachers are also required to construct their understanding of pedagogical principles in relation to a topic in any content area. They also create an IT-based task that would span a curriculum time frame of two to three weeks for a target group of K-12 students. During class presentations, trainee-teachers defend the effectiveness of their IT-

based products (e.g., *WebQuest* projects) as a pedagogical tool in meeting learners' needs in classrooms and catering to individual differences. Self and peer evaluation are also required. There is the dual focus on processes (with an emphasis on thinking and reflection at levels of analysis, synthesis, and evaluation) as well as on products of learning.

6. **IT as a cognitive tool**. IT tools, for example concept-mapping tools, which facilitate higher-order thinking, are adopted in some of the modules in NIE. Thinking templates, for example, compare and contrast structures and other epistemic forms, have been practiced among the trainee-teachers. Figure 4 shows an example of a concept map developed for the purposes of delineating dimensions of online discussions. Concept maps are used to engage trainee-teachers in reflecting on materials they have read, for example, the content of online discourse.

The example in Figure 4 reveals that online discussion is a key to online learning where dialog is an integral part of the students' learning process. From the dialogical process, the principles of distributed



**Figure 3.** Visualization of concepts.

expertise, contextualized engagement, and reflection occur. From the above example, we hope to connote that higher-order thinking involved when engaged in concept mapping is able to aid students in distilling out the principles (of online dialog) involved amidst a host of details.

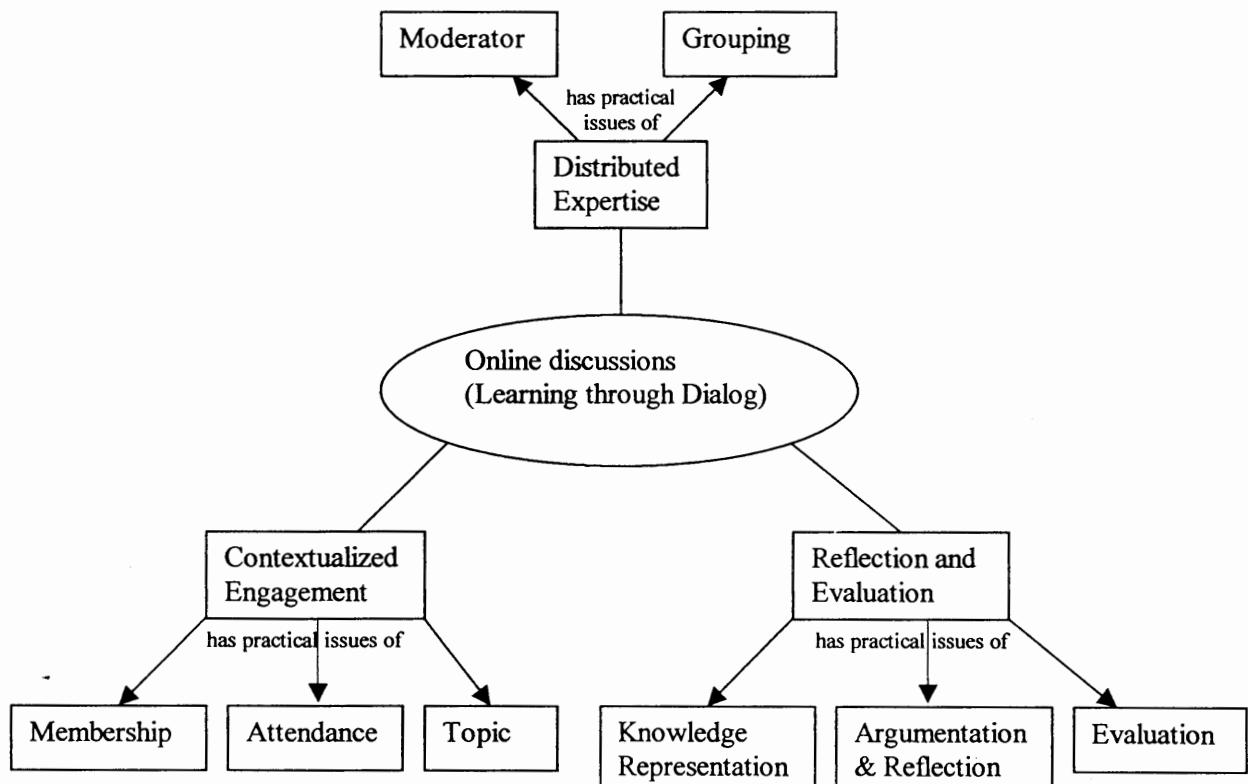
### Discussion

In this section, we discuss some of the issues and dilemmas schools in Singapore are faced with amidst the wave of online learning initiatives. Recognizing the potential benefits of such a tool, schools are struggling to adapt, yet preserve traditional cornerstones that have been effective for many decades. Such issues are of concern both in local K-12 schools and also at the National Institute of Education,

**Balancing between maintaining past achievements and attempts to change.** Seemingly, Singapore has been ranked as one of the top nations in international examinations in Science and Mathematics, not due to a constructivist pedagogy per se, but rather from the

traditional mode through which education has been formed. For this reason, the traditional emphasis on 'examination results' as a focus is still predominant in the local schools.

As we have seen from the IT projects undertaken by schools, the focus of online learning is not merely on tests and examinations, but also on the quality of thinking processes in activities such as project work. However, some "kiasu" (a local term referring to a state of mind as being afraid of losing out) teachers and parents are worried that students' time and effort spent on thinking processes in IT projects may divert attention from the emphasis on regurgitating (an implicit belief) content knowledge, and thus affect their performance on exams. The oft reservation from "kiasu" teachers is that online learning is expensive and may not necessarily prove more effective for learning compared with the old, tested ways of classroom instruction. Indeed, this would seem valid as long as learning in the school context is confined within its singular boundaries and the communications'



**Figure 4.** Example of a concept map on online discussions.

technologies and the advantages of IT tools not maximized (e.g., see the advantages of visualization, Figure 3). This concern, consequently, delimits innovative ideas for IT integration as many such projects are usually conducted during school holidays as special project camps.

Maintaining this delicate balance between achieving good performances on tests and attending to the meta-cognitive aspect of learning has become a major challenge. We reckon that many problems and issues remain in the implementation of online learning and IT in Singapore schools. The most important issue probably is how IT tools and online learning can effectively be integrated into the school curriculum over the coming years (and how IT in project work can be an integral part of the school curriculum).

**Involvement of e-learning service providers.** With the dominance of e-learning in schools, service providers are promising *learning* through such means. It seems to be a 'quick fix' in helping schools to catch on to the e-learning fashion or wave. E-learning platforms and environments can even be perceived as off-loading unnecessary curricular and administrative burdens from teachers. With such a prevailing phenomena, quality

control becomes an issue. The involvement of commercial service providers in the education sector deserves close monitoring. A recent survey done on e-learning in Singapore ([www.knowledgeplatform.com](http://www.knowledgeplatform.com)) indicates that indeed 'quality is a worry.' Fortunately, we are delighted to observe that increasingly local e-learning providers (such as *Ednovation* and *AsknLearn*) in Singapore have approached the National Institute of Education, initiating joint projects for realizing pedagogically meaningful online learning environments for use in the local schools. Moreover, these local service providers are also co-organizing e-learning activities and programs with NIE for the schools in Singapore. The Ministry of Education (Singapore) has also created a portal conducting some inservice courses in conjunction with NIE. The biomechanics module (see Figure 3) is an example of an inservice module through the VITAL (Virtual Institute of Training and Learning) portal. In addition, NIE has also developed in-house applications such as data management and assessment tools, and schools are also adopting some of these tools. This unique tripartite collaborative relationship between the school, the industry, and the teacher training institution (NIE) may prove productive

and provide useful experiences for other regions in the Asia-Pacific and around the world.

### **Integrating face-to-face and online learning.**

Because of the concern related to maintaining past academic achievements, most online projects have been carefully designed to integrate both the face-to-face and the online distance education approaches. This tight integration is probably partly due to the unique Singaporean characteristics of a city country. There are virtually no suburban areas in Singapore. With the convenience of the mass rapid transport system, schools are physically and readily accessible by all. When learning goes online, there must be an imperative reason! In Singapore, integrating the face-to-face and online learning approaches seems to be taken as a *given*. Both face-to-face and online learning approaches warrant certain merits, and the advantages of each approach should be maximized for the effectiveness of learning. The social interactions involved in face-to-face settings are different from that of online environments, whereas online learning facilitates interactions with certain individuals and experts that may be unavailable locally or in the immediate physical context.

At the National Institute of Education, there is also an increasing recognition as to the kinds of courses which lend themselves to online interaction and those that are better conducted through traditional means, or a complement of both. Taking the classroom management example (see Figure 1), a blended approach of both traditional and online interactions is adopted. While the trainee-teachers are on-campus, more traditional approaches, such as class discussions and tutorials, are adopted. But when actual, real cases are to be used for instruction, communication with schools and inservice practitioners via technology becomes a real advantage (see Figure 2).

**Participatory online learning.** We have mentioned in the above that the directions in online learning and pedagogy could possibly be toward problem-centered approaches. PBL approaches are considered *simulation* models (Barab & Duffy, 2000) of learning—bringing the real problems of the community into the classroom. On the other hand, *participation* models bring the students into the real community of practice. Barab and Duffy (2000) stress that *participation* models foster the enculturation of dispositions of practitioners, for example, how mathematicians perceive the 'way of seeing' mathematical meanings. In other words, in addition to learning *about* a trait of practice, one learns to *be* a central participant of the community of practice (Lave & Wenger, 1991). Being a central participant denotes that the individual possesses an identity similar to the practitioners of the community. Unfortunately, the lack of the "learning to be" (identity and dispositional aspects of learning) capability for online learning in general makes virtual learning communities

quasi-communities at best (Hung & Chen, 2002).

With Singapore's advancement of IT integration in the work force and its tight integration of face-to-face and online approaches to learning, there is a unique opportunity for Singapore to experiment with the participatory approach to online learning. Such an experience may only be feasible in small countries, which are flexible enough to make drastic changes at the national level.

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## **Conclusion**

With the future thrust of the IT MasterPlan II to be more specifically focused on learning processes, Web-based online learning and communities will be areas of particular interest to enhance the learning and social inter-relationships between all learners and other parties. Moreover, real-life authentic tasks from within communities of practice can be made relevant to instruction through the communications technology afforded through the Internet. The future directions for online learning will be conceived in tandem with curriculum and pedagogical reforms based on informed research.

Singapore needs to reconcile its dilemma of facing up to newer educational practices that, in its opinion, are absolutely necessary for economic and social progress yet wishing to keep the tenets of past successes. The challenge is to recognize traditions that must be preserved while transforming those impeding progress. This transformation may require us to "think outside of the box." Albert Einstein's remarks seem an apt closure: "The significant problems we face cannot be solved at the same level of thinking we were at when we created them."

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## Author Guidelines for Magazine Articles

In preparing an article for *Educational Technology* Magazine the primary fact to keep in mind is that this magazine is not a research journal. It is, as the name implies, a magazine. The Editors are looking generally for articles which *interpret* research and/or practical applications of scientific knowledge in education and training environments.

Thus, your article should not be cast in the form of a traditional research report. The facts of your research, and the research of others, should be stated succinctly. Then you should go on to explain the implications of this research, how it can be applied in actual practice, what suggestions can be made to school administrators, trainers, designers, and others.

The style of writing should be on the informal side—an essay—since once again this is a magazine and not a formal academic journal. Authors are free to state their opinions, as long as the opinions are clearly identified as such. The use of specialized jargon should be kept to a minimum, since this magazine has a very wide interdisciplinary audience and what may be common words in one sub-field of educational technology will be considered unintelligible to others.

There are no minimum and maximum length restrictions. Make your article about as short as possible to do the job you intend.

# On-Campus and Online in Australia: Issues Emerging from This Convergence of Technologies

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Peter G. Taylor  
Bond University, Australia

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Higher education in most economically-developed countries is now facing a number of challenges that are quantitatively and qualitatively different from those they have previously faced, including the introduction of the 'new' information and communications technologies (ICTs). This introduction is often justified in terms of the need to respond to what Ehrmann (1996) refers to as higher education's 'triple challenge'—to increase the accessibility of *high-quality* education in *cost-effective* ways. Many Australian universities are linking the introduction of ICTs to the notion of student-centeredness and referring to the emergent and convergent educational practices as 'flexible learning.' The resultant flexible learning environments share, to varying degrees, three features:

- decreasing reliance on face-to-face teaching;
- increasing reliance on student self-management and independence; and,
- increasing reliance on ICTs, particularly the use of the Internet, in teaching and learning.

My point is that universities are responding to particular challenges (see also CRHEFP, 1998; and NCIHE 1997), and those who work and learn in them are, in turn, having to adapt to those responses.

The introduction of learning technologies changes the roles of staff and students. Much has been written about the need to support academics' changing roles (e.g., Taylor, 1998, 1999). However, in this article, I

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