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As an instructional medium, IT does not necessarily cause changes or improvements in teaching and learning. This CDTL Brief presents the first of a two-part discussion on how instructors may utilise the options and opportunities in ***IT-supported Learning Strategies*** *for improved teaching and learning.*

Embracing Appropriate Technology in Teaching and Learning

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Introduction

One of the most obvious trends on university campuses in recent years is the increased use of technology to support instruction and learning. Integration of technology into teaching and learning, however, remains the single most important information technology challenge confronting universities around the globe.

Simply attaching technology to existing classroom instruction or converting instruction to use technology may yield some benefits; however, it does not necessarily enhance learning. For instance, posting a syllabus or lecture notes on the Web may allow students to access the material in a more convenient manner, but the Internet is used only as a medium of delivery.

Instructors need to redesign instructional content to take advantage of the possibilities that technology offers. In other words, teachers should incorporate technology that can add value to the traditional classroom activities. To provide value added technology-delivered instruction, instructors might want to consider the following suggestions that use technology as a supplement to classroom activities:

- Using computer simulations.
- Connecting students from different universities in order to exchange information on group projects.
- Using videoconferencing to connect people from the private or public sectors to interact with students in the classroom.

Technology can be used as a supplement or replacement to a traditional lecture course. This article will focus on the discussion of implementing technology as a supplement, using seven principles for good practice in undergraduate instruction. Lessons learnt about the use of technologies will also be discussed.

Implementing technology as a supplement

Any given instructional strategy can be supported by various technologies and vice versa. However, some technologies are better than others and add more value to the instructional strategy. Chickering & Gamson (1991) specified seven principles for good practice in undergraduate instruction that have been widely implemented in higher education and are now considered best practices in and out of classrooms. Using these seven principles as guidelines, the following are some of the technologies I use in classrooms:

1. *Good practice encourages student-faculty contact*.

   It is important for instructors and students to have frequent interaction. This not only allows the instructors to know where the students are, but also enables the teachers to help the students when difficulties arise. As a result, students become motivated and involved in the coursework, knowing that the instructors care about their progress. Instructors usually have office hours during the week. Email can be used as a means to provide student-faculty contact outside these hours even if the instructors are not physically in their offices. I use email to facilitate questions from students in large classes or those who don't have an opportunity to ask questions after class (e.g. students who need to leave quickly). In addition to email, listserv, chat room and videoconferencing are also effective technologies that can be used to encourage student-faculty contact.

2. *Good practice encourages cooperation among students*.

   Learning is enhanced when students work cooperatively. Email again can be an effective tool to generate communication among classmates when they are not physically together. I also use threaded discussion

forums via Web Course Tools (WebCT[1]) to generate discussion topics and have students post their responses when they wish within a deadline. Chat rooms allow students to interact in real time when they need to discuss a certain aspect of their courses. Videoconferencing permits students to interact in real time when discussing a project.

3. *Good practice encourages active learning.*

   Students learn more when they are actively engaged in learning. Using computer simulations in or out of class engages students in a deeper exploration of the concepts and allows them to acquire a better understanding. I provide Java applets simulations on the Internet for students. I also require students to search for information on the Internet that is not available in the local library, thus forcing them to become actively involved in making choices and judgments about what they require for their projects.

4. *Good practice gives prompt feedback.*

   Frequent feedback on small units avoids misunderstandings that could be addressed prior to feedback on larger units. Email allows person-to-person feedback, while listserv allows me to provide feedback to a group of students as well as comment on projects and other group activities. Instructors can put tutorial questions on computer programs that provide immediate feedback to students based on their responses to the questions.

5. *Good practice emphasises time on task.*

   Good time management skills are crucial for both students and professionals. Technology can maximise time spent on studying by making the process more efficient. For example, students can learn some aspects of the course at home or work, and they can ask instructor questions or communicate with classmates without commuting to and from campus. This allows learners to fit more study time into their busy schedules.

6. *Good practice communicates high expectations.*

   When instructors communicate their high expectations to the students clearly, students will try harder and learn more. Listserv gives me the opportunity to communicate my expectations to students on assignments, projects and exams clearly. Publishing students' work on the Internet stimulates interest in working harder on a project because the students know that the finished project will be available for others to examine.

7. *Good practice respects diverse talents and ways of learning.*

   Each student is an individual who possesses different talents and styles of learning. Learning is enhanced when instructors take this into consideration when implementing teaching strategies. Existing multimedia resources (e.g. graphics, audio, animation and video) can be used to support different methods of learning. Students can choose to learn in the ways they find most effective.

1. WebCT is a multi-featured online course development and presentation server available to faculty at the University of Victoria at no charge.

Lessons learned on the use of technology

When the use of technology is based on the seven principles for good practice in undergraduate instruction, it helps enhance students' learning. However, it is important to ensure that the technologies are implemented effectively to provide the desired results. Some of the lessons I have learned on implementing technologies include the following:

- Let students know how often email will be accessed. I provide fast feedback to students, and promise a fuller response later if required.
- Personalise email communications by using students' first names.
- Inform students that having computer access to email and the Internet is important in the course.
- Ensure that all students have some way to access the Internet and address any issues that might arise (e.g. hardware differences and software problems).

The following are feedback from some students on aspects of my approach that stood out as being most influential to their learning:

- "Answers questions promptly and was very accessible as far as e-mailing questions."
- "She was easily approachable and responded promptly to e-mail."
- "Postings on the Net. Prompt in responding to questions and concerns."
- "She tried to encourage discussions online and answered emails promptly."
- "She responded quickly and readily to all online questions."

Conclusion

When technology is appropriately used in instructional environments, it will have a strong, positive influence on students' learning. Technology offers instructors excellent tools that can benefit students. However, not every use of technology helps enhance student learning. Instructors need to examine the use of technology as a supplement to their teaching strategies to ensure that it actually adds value to the course. By using the seven principles of good practice as a guideline to implementing technology in the classroom, teachers can be confident that they are creating a good learning environment for their students.

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Information Communication Technology Mediated Learning

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Meaning making in a real-world situation is context-diverse and requires deep thinking, soliciting opinions and engaging the thoughts of others through communication. Traditionally, technology has been used to deliver and communicate instructions to the student who will hopefully comprehend those instructions and learn from them. It is also assumed that people learn from technology, by watching television or documentaries, responding to programmed instruction or listening to a teacher in class. But Jonassen (1992) argues that technology does not directly mediate learning. Instead, learning is mediated by thinking, and thinking is set in motion by learning activities, and learning activities are mediated by instructional interventions, including technology. This article will briefly mention the background of the use of Information Communication Technology (ICT) in learning, discuss why ICT is able to elicit meaningful learning from learners who are dispersed in space and time, as well as describe a way of how this is achieved.

Historical & theoretical background

Since the commercialisation of the Internet around the mid-90s, we have observed not only a stark transformation of the educational landscape, but also a shift in the educational value system in favour of instructors facilitating social learning, nurturing critical and independent thinking, as well as inculcating life-long learning skills and habits. Much of this transformation has been based on the application of socio-constructivist learning theory. As a philosophy of learning, constructivism is "founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in" (On Purpose Associates, 1998–2001). As an extension of the constructivist view of personal effort in meaning making, socio-constructivism theorises that the meaningful construction of knowledge occurs when a learner interacts with other learners.

Epistemological basis for ICT-mediated learning

If learning is a generative process, the mind is always in search of and is responsible for knowledge acquisition through the engagement of cognitive processing based on prior knowledge and experiences. But "it is not reasonable to assume that all knowledge should be personally constructed, as completely idiosyncratic knowledge constructions would result in intellectual chaos. Socially constructed reality will always maintain an important role in society" and constitutes the "conceptual glue that reconciles schemas and the glue that hold societies together" (Jonassen, 1992. p. 5). Hence, while it is conceptually viable to implement socio-constructivist learning in the classroom, it was not until the advent of ICT that we have begun to see how social learning is able to take place beyond the classroom spanning across cities, countries, continents and time zones.

At the heart of an ICT-mediated socio-constructivist learning environment is the joint-problem-space (JPS). By definition, a JPS "is a shared knowledge structure that supports problem solving activity by integrating goals, descriptions of the current problem state, awareness of available problem solving equations"/resources and "those associations that relate goals, features of the current problem state, and available actions" (Roschelle & Teasley, 1995, p. 70). An ICT-supported JPS is able to sustain synchronous[1] and/or asynchronous collaborative work between geographically dispersed learners in different time zones. Consequently through an ICT-aided JPS, collaborative problem solving "amplifies the learner's cognitive processes while using those technologies" (Jonassen, 1992, p. 3) which make it possible for peers separated by distance and time zones to solve problems within "a negotiated and shared conceptual space, constructed through the external mediational framework of shared language, situation and activity—not merely inside the cognitive contents of each individual's head" (Roschelle & Teasley, 1995, p. 71).

Features of an ICT-mediated learning environment

ICT is able to embody JPS by providing functional features such as information banks, symbol pads, construction kits, phenomenaria[2] and task managers (Duffy & Jonassen, 1992) that could be integrated within a Learning Management System[3] (LMS). Jonassen states that these features facilitate a series of interactive online activities that "trigger the

1. Occurring or existing at the same time, or having the same period or phase (adapted from the definition supplied by *http://www.dictionary.com/* (Last accessed: 30 December 2002).
2. An area for specific purpose of presenting phenomena and making them accessible to scrutiny and manipulation such as e.g. online hub and spoke diagrams, "experimental apparatus, simulation games physics 'microworlds' " (Duffy & Jonassen, 1992. p.47) and constructivist games such as Civilization and SimCity.
3. A web-based software solution that support, tracks, administers and manages the delivery of learning.

learners' schemata[4]" and prompt learners to interpret new information for themselves and in mutual consultation with other learners; after assimilating new information back into their schemata, "learners reorganise their schemata in the light of the newly interpreted information, and then use those newly aggrandised schemata to explain, interpret, or infer new knowledge" (Jonassen, 1992, p. 3). Lest the learners construct knowledge that is "completely idiosyncratic" and "results in intellectual chaos" (Jonassen, 1992, p. 5), it is vital that a Subject Matter Expert[5] (SME) validates this new knowledge. By functioning as an e-Coach[6], the SME provides a crucial element of human intervention within an ICT-mediated learning environment to eradicate any misconceptions that learners might have as they construct new knowledge.

An example of how ICT can mediate learning

One technical example of ICT-mediated learning is to ask learners to make decisions about an online case study, or a series of online case studies, by manipulating variables and then checking boxes, radio-buttons or clicking hotspots via a web form. ICT encapsulates learners' inputs through these web forms and then retains the inputs within a database repository, each web form creating a new data entry record in the repository. Each record can be retrieved from the database, collated with other records and displayed on an Active-Server-Page[7] (ASP). The ASP will bring to the learners' attention any misconceptions of making a particular choice(s); it pegs and displays the overall percentage of all other learners who have made the same choice(s) alongside the choice(s) made by the learner.

Next, the teacher or SME functions as an e-Coach to give overall comments on the activity and facilitate a peer review process through the use of an online discussion forum within the LMS hosting the learning activity, or that functions independently from the host LMS. The e-Coach monitors if learners have any misconceptions about the subject matter and intervenes when the discussion is derailed. Alternatively, discussions can be conducted synchronously using chat rooms; but unless well regulated, chat rooms can be very chaotic when participants try to chat simultaneously.

4. A pattern imposed on complex reality or experience to help explain that reality, mediate perception, or guide response (adapted from the definition supplied by *http://www.dictionary.com/* (Last accessed: 30 December 2002).

5. An individual who exhibits the highest-level domain of knowledge.

6. A Subject Matter Expert who mediates learning by eradicating learner misconception; who encourages online participation, managers and resolves conflict, and maintains decorum at the discussion forum.

7. An HTML page that includes small, embedded programs that are processed on a Microsoft Web server before the page is sent to the user adapted from the definition supplied by Refsnes Data, (1999–2003), 'Introduction to ASP', W3Schools.Com, *http://www.w3schools.com/asp/asp_intro.asp* (Last accessed: 3 January 2003).

Caveats

Implementing an ICT-mediated socio-constructivist learning environment is not without drawbacks such as a high attrition rate. Frequently, many learners may participate in online activities out of necessity or curiosity; however, their participation rate, especially in discussion forums, tends to diminish over time. This may be due to a lack of motivation, cultural clashes, fear of rebuttal and losing face, fear of engagement because of language difficulties, or a combination of such factors.

To combat attrition rates, one can communicate a consequence of non-participation or enforce some sort of penalty if learners are found to be over-domineering or defiant within discussion forums. A positive way to encourage motivation is to award points for putting up a good argument that helps other learners learn.

Conclusion

No matter how sophisticated ICT may be, it is incapable of thought and merely facilitates the scaffolding of knowledge. Unlike a competent human e-Coach, ICT cannot ascertain a learner's motivational levels and language skills, detect semantic and cultural differences, and gauge learners' communication abilities. Not all learners possess the same intellect and effective questioning skills that will help them engage in profitable dialogue and cut through information overload. In this regard, when machines solely mediate teaching and learning, such efforts are likely to be doomed to failure. Hence, the presence of a competent e-Coach (e.g. who is knowledgeable, able to encourage participation, communicates well) is vital in making ICT-mediated learning succeed.

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Supporting Online Learners in a Constructivist Manner: A Case for Future Development Work in the Singapore Context

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The manner in which computer-based technology is (or should be) integrated into contemporary teaching and learning practice is a topic of extensive debate because few agree on how this can be done successfully. For instance, Sandholtz, *et al*. (1997) contend that: "Technology is most powerful when used with constructivist teaching approaches that emphasise problem solving, concept development, and critical thinking rather than simple acquisition of factual knowledge" (p. 174). But what challenges face teachers who wish/must make the transition to constructivism?

Based on the need to ground educational commentary in specific contexts, this article glimpses at the authors' work by reflecting on a critical teaching incident relating to the use of information and communication technology (ICT) to 'support' online language learning. Although the following discussion is speculative, it is based on our experiences of setting up and working in online learning environments in Singapore. We end by proposing a possible direction for further work in understanding how teachers can best overhaul their teaching and learning approaches in the information age.

Critical incident

> "I have found that if I just have a quick look through the test, I can catch the brief meaning of it, but unfortunately, I can't understand the detailed information very well. So, my question is: how can I improve the percentage of comprehension while the speed is very fast? Can I find a way to balance the reading speed and the comprehension rate? I can understand that the reading improvement needs time, but is there a shorter cut to solve the problem?"

This text is taken from an email message that was sent to the second-named author by a female Chinese tutee attending an intensive English communications skills programme. She was a volunteer in a research study and these comments were received soon after she received a score of 30% in an initial online multiple-choice assessment test in reading comprehension.

The tutor, who had developed the testing material in question, perceived that his student would be disappointed if she got another low score in the next test. Thus, he spent time composing a response that was designed to be supportive and reassuring. He offered to work with his tutee in developing learning strategies for dealing with challenging material online. In particular, he suggested that she scanned reading passages first before attempting to deal with the questions in detail. He also pointed out that readers usually have some background knowledge of a subject area and that this can be deployed in decoding text. He ended by instructing his student to frame focus questions before embarking on a reading passage because decontextualised information is very difficult to understand. In due course, the student thanked the tutor for his time and advice. She never mentioned the topic of reading comprehension again!

Critique

What effect(s) on learning were produced by this case?

First, let us assume that the tutor did his best under the circumstances. He fulfilled his function as 'expert' by suggesting ways to approach a traditional comprehension test. However, it can also be argued that his actions only scratched the surface of the student's concerns. If any learning occurred, it is perhaps best described as 'fragile' and 'decontextualised' (Brown, *et al.*, 1989).

Perhaps we need to reconsider the purposes and methods of language comprehension testing within a system that places a high value on performance under controlled circumstances.

> "The activity in which knowledge is developed and deployed…is an integral part of what is learned. Situations might be said to co-produce knowledge through activity. Learning and cognition, it is now possible to argue, are fundamentally situated." (Brown, *et al.*, 1989)

The act of decontextualising a text actually makes comprehension artificially much more difficult to achieve.

All meaning is situated; activity and situations are integral to cognition and learning. It can be argued that language learning, especially in a professional context, needs to be based around both comprehension and authentic application, not as isolated events but as integrated experiences.

Handled differently, reading comprehension could be 'tested' by asking students to develop and write a report on how to solve a problem or a case study arising from authentic circumstances. To assist, students could be given access to an appropriate 'case library' (Weigel, 2002) that contains relevant context-sensitive documents that are written in a range of styles. Students could then be tasked to understand, synthesise and represent a range of information in their own words.

As far as assessment goes, the students' reports could be evaluated using a rubric that covered a range of performance factors. In addition, if discussion groups were used, evidence would be available concerning how they reached their solutions and these could guide them in developing necessary strategies 'just in time' as opposed to retroactively.

Pedagogical implications

The proceeding discussion is not to be taken as a recommendation to use problem solving or selected values and methods from constructivism to 'tweak' classroom practice. This is because constructivism is unlikely to cure the ills of an existing system that favours decontextualised learning. At worst, inappropriately applied innovations have a tendency to create aberrant learning behaviours and unnecessary stress.

> "Constructivist conceptions of learning assume that knowledge is individually constructed and socially co-constructed by learners based on their interpretations of experiences in the world. Since knowledge cannot be transmitted, instruction should consist of experiences that facilitate knowledge construction." (Jonassen, 1999)

In our estimation, the only potentially effective way of dealing with traditional methods of education is to start by building learning environments from scratch.

As Singapore currently advocates the use of ICT to support student-centred approaches and deep learning methods, we propose to conduct further work in order to produce models of good teaching and learning practice that are appropriate for implementation in the local context. This could be achieved by:

a. charting pathways for designing, producing and implementing learning tasks that are driven by realistic problems and the need for self-directed enquiry; and

b. providing a rationale for pedagogic change that is grounded in authentic practice and is designed to help teachers and learners leverage on the power of ICT to save time and share their resources.

Finally, it is essential for us to build a corpus of knowledge about teachers and learners' experiences of using ICT in Singapore. Readers, therefore, are invited to contact us to share their anecdotes, cases and problems. The greater the pool of information that we have to work with, the better our chances are of producing work that is of value to the widest possible audience. We look forward to hearing from you.

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The Centre for Development of Teaching and Learning (CDTL) engages in a wide range of activities to promote good teaching and learning at the National University of Singapore, including professional development, teaching and learning support, research on educational issues, and instructional design and development.

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