Preparing Student Teachers for IT Integration into Instruction

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Abstract

In 1997, the IT Masterplan for Education was launched, specifying various goals and directions for which schools and teachers should be heading in the use of IT in education. In tandem with the Masterplan, the National Institute of Education also revised its curricula for the initial teacher training programmes to equip new teachers with skills, knowledge and pedagogy on the use of IT in the teaching and learning process.

In anticipation of the thrust of the IT Masterplan, the Instructional Technology module, a compulsory module for all student teachers, was re-designed to take into consideration the aims of the IT Masterplan. The course was designed based on a theoretical framework of a set of IT competencies for teachers, and with a constructivist view of teaching. The emphasis of the new training program is to prepare teachers to teach in a different learning environment utilising various forms of technological tools to help promote deeper learning and thinking.

Introduction

The main thrust of the IT Masterplan for Education under the section of Human Resource Development is a call for the training of teachers to "handle IT-based instruction and support new learning strategies among their pupils" (IT Masterplan for Education, 1997). Training of teachers for this objective is a key issue, and is one of the most important factors that will help to make the IT Masterplan a success. Training teachers in the use of IT for teaching is more than getting them familiar with various productivity tools (e.g. word processing, spreadsheet, databases, etc.). Instead, teachers will have to change their instructional strategies and the way they conduct their classes. In order for the Masterplan to work, teachers must be equipped with relevant skills so that they can help to make realise the plan.

The general training strategy adopted by the Ministry of Education is to divide the schools into three phases and provide the schools with initial school-based training conducted by Senior IT Instructors from Educational Technology Division (ETD). Teacher training in schools on the use of IT in classroom teaching began in 1997 and is still on-going. The first phase started in 1997 with 22 schools and 90 schools were involved in phase two. Beginning in January 1999, the remaining 250 schools will come on board, and by the year 2000 all teachers will be trained.

In the Masterplan, it was stated that the National Institute of Education on its part will help in the implementation of IT Masterplan by ensuring that its student teachers have acquired core skills in integrating IT resources into the school curriculum. With this focus in mind, a new component which integrates IT into the teaching methods in the curriculum studies modules was introduced. Similarly, the foundation Instructional Technology module was re-vamped and new components were added. This paper describes the philosophy, rationale, objectives and the approaches used in the new Instructional Technology course.
Background

The use of computers in Singapore schools began about 1980. In the period from 1980 to 1990, most of the computer activities in the school concentrated on learning how to use computers. The emphasis then was on computer awareness, computer literacy, and computer appreciation. Mrs Maureen Ng, Deputy Director of Educational Technology Dept of in the Ministry of Education, ("'CDIS playing", 1988 December 12) rationalised the importance of computer literacy in the school, saying, "By endeavouring to make computer literacy available to all students, we hope to make it a life skill that one cannot do without. ... We are thinking about how our present children would become tomorrow's new breed of workers who may have no choice but be computer literate.”

Teacher training was also a focus during this phase. To implement these computer courses in the schools, there needed to be trained teachers. Various teacher training courses were conducted by the local university and the teacher training institute to help teachers incorporate computers in the schools. There was a variety of training opportunities for teachers, for example: an in-service course to help teachers to manage the school's computer clubs; a full-time one-year diploma course to equip teachers to teach Computer Science as a university matriculating subject; and an in-service course to equip teachers to conduct computer literacy courses in secondary schools (Wong, 1998).

The Instructional Technology course in the late 80s and early 90s concentrated on equipping teachers with skills to work with computers. At that time, computers were not as powerful as it is today, and there was limited software available for use in the schools. In the Instructional Technology course, trainee teachers were taught to use the word processor, simple desktop publishing software to prepare cards, banners, and hand-outs, and various productivity tools such as spreadsheet and databases. Basically, the course at that time was very skill-based. This example of skill-based curriculum in initial teacher training programs was widespread, and many overseas universities and teacher-training colleges were using that model during that period.

The move away from skill-based curriculum to pedagogy-based curriculum in the Institute was initiated in 1993. To substantiate the move, Wong and Williams (1994) conducted a study to determine student teachers' skills in using the computer and their familiarity with terms associated with software. The objective of the study was to determine the type of entry level competencies that the trainees have so that the course could move into a pedagogy-based one. The study was conducted with 247 postgraduate trainees in the primary and secondary cohort. In their study, they found that 86% of the postgraduate student teachers had some working experience in the use of a word processing package, 6.4% of them had used multimedia packages, and 18.9% had used communications package (e-mail). The figures would now be considered low but that study was conducted in 1994. At that time, various computer jargon and terms such as WWW, Internet, IRC, e-mail, video-conferencing were not part of the common vocabulary as they are today. At that time too, Internet was not a household word, and there was no Internet Service Provider in Singapore. So, it was not surprising that the level of usage in communications packages was practically non-existent, and that trainee's experience with multimedia packages was very low. On the other hand, trainees had working experience with word processing. This is understandable as most of the trainees were recent graduates from the University, and had use word processing package to help them to prepare term papers and assignments. In 1994, thus, the compulsory Instructional Technology module had a large component focussing on the development of IT skills such as using a multimedia presentation package to prepare teaching materials, but moving away from basic skills like word-processing.

The recent initiatives in education, viz. thinking skills, National Education and the launching of the IT Masterplan, provided the impetus to reconceptualise the Instructional Technology course and redesign the curriculum. To re-design the curriculum the team members returned to the basics of curriculum development: stating the philosophy of the course, the objectives and identifying the kinds of skills, competencies and knowledge a teacher should have in order to teach in an IT-based classroom.
When we began the design process, we wished to lay down the philosophy of the course so to be the guiding factor when we revised the curriculum. The following are the underlying philosophy statements which guided us in re-designing the course:

a. We wanted the course to be an IT-pedagogy based and not a skill-based course. To move away from a skill-based course to one which is pedagogy-based, we needed a mechanism to help student teachers who do not have the necessary basic IT skills to acquire the necessary pre-requisite skills.

b. We wanted to promote independent learning so that the trainees experience the effects of independent learning and possibly apply it to the schools. To achieve that we decided to reduce the number of mass lectures by 50% and replace that time with self-learning activities.

c. We wanted to move away from traditional classroom teaching style which emphasises directed teaching. Instead, we felt that the student teachers should experience learning in new environments. For example, to understand the concept of independent learning, they themselves need to experience independent learning, making decisions, self-regulating their own learning, etc. Another example is the principle of constructivist learning model. Again, the module incorporates activities which illustrates good examples of constructivist learning.

d. In line with learning in new environments, we felt that trainees should experience experiential learning in order for them to concretize the concepts associated with teaching in new environments. For example, to understand the concept of independent learning, they themselves need to experience independent learning, making decisions, self-regulating their own learning, etc.

e. We wanted to use technology to help in delivering the course. In other words, using technology to teach about using technology in the classroom. To adhere to this philosophy, we would need to relook into the instructional materials and consider redesigning them.

f. To correctly reflect the new approach in training, the mode of assessment has to be changed, as well. We decided against the multiple-choice format test items used previously, and instead opted to go for project-based assessment and open-ended evaluation tools.

These philosophy statements are the foundation to help us re-design the curriculum of the module. Because of the philosophy that we had defined, we needed to change the way the course was planned and conducted. We changed the instructional strategies used in tutorials, we redeveloped the learning materials into self-learning instructional materials which were posted on the world wide web, we redefined instructional tasks to incorporate collaborative work and in-class presentation, and changed the assessment modes to fit the new curriculum.

**IT competencies for teachers.**

To design a course for student teachers in IT, it is necessary to define the competencies that student teachers will acquire at the end of the course. Williams and Wong (1998) proposed a set of IT competencies that a teacher should have in order to fully utilise the power of IT to enhance the teaching and learning process. The competencies and skills identified in their list are comprehensive, and a teacher would normally take a number of courses to acquire these skills and competencies.

The developmental model of competencies are categorised into three different levels and is presented in Table 1. In the *Acquisition* stage, teachers build up foundation IT skills and become comfortable using IT jargon, and in using general IT productivity tools. At this stage of development teachers familiarise themselves with general productivity tools to help them in their administrative work and in the preparation of teaching materials. Also, at this stage, teachers should be familiar with the use
of Internet and web-based resources, using multimedia presentation packages to prepare instructional materials. In the Application stage, teachers become more knowledgeable about how to select and evaluate CBL, and to integrate IT into their lesson. In the final stage, Innovation, the teachers become very adept using computers, to the extent they can author their own multimedia materials for use in their classes, and to design and maintain their own instructional web sites.

It is assumed that teachers will follow the sequence of stages more or less developmentally, that is, needing to complete the Acquisition stage competencies before progressing to the Application stage competencies, and then on to the Innovation stage. Inside each stage, however, there is no particular order for the competencies shown here.

As this is module is an introductory program to train teachers to use IT for classroom teaching, it is not possible to teach the student teachers all the skills and competencies stated in the competency list. Instead, a number of core competencies within each stage was identified, and the course was built around it.

Structure of the course
Our vision is that the course will develop the teachers’ pedagogical skills with IT, and that trainees at the end will feel comfortable and be able to use technology in their own classes to promote higher order thinking.

Figure 1: Component objectives breakdown for the Instructional Technology course
We decided on three main elements in the course and they are design, technology and pedagogy (see Figure I). These elements form the framework on which the course would be built. Technology, while important in today’s world, constitutes only 30% of the course content and time, while 50% of the time is to be devoted to pedagogy with IT. The remainder 20% curriculum time is to be spent on design. Within each element, we identified various areas that are important to teachers at this initial stage of their teaching career.

a. In the Design component, we concentrated on applying visual design principles in the preparation of learning materials and in assessing the production quality of materials developed. From past experiences, we noticed that the student teachers are poor in visual design, layout, and colour schemes, and felt that this section on applications of visual design in their work was necessary.

b. In the Pedagogy component, the student teachers will familiarise with strategies, methods and development of materials for IT-based lessons. They will, for example, develop materials to promote thinking, manage the learning process, integrate IT resources in lessons, apply constructivist approaches to teaching and conduct collaborative work in IT-based projects.

c. In the Technology component, we wanted our student teachers to familiarise themselves with various IT tools & resources such as digitising equipment (cameras, video, scanners), electronic and internet chat systems, video conferencing systems and other forms of new technology, together with their applications to the teaching and learning process. The Student teachers will need to acquire Internet skills such as searching, downloading files and pictures and evaluating Internet resources suitable for teaching. The third major component under this category is selecting and evaluating CD-ROM materials.

Assessment of the different components
Because of the different components within the module, different sets of tasks were developed to assess the student teachers competency level. Five tasks were developed and a description of these tasks is described below.

Task 1: Reading table. While we were encouraging the student teachers to read from the required text and lecture notes prepared by the lecturers, there is no feasible means from which we could determine whether they do perform the task. Previously, we prepared multiple choice questions to test students’ reading knowledge but this mode of assessment is limited. Instead, for this reading task, the trainees during tutorial time need to summarise the main points of the reading material, and to suggest how the contents of the readings are applicable to classroom teaching.

Task 2: Computer-based Instruction. There are two sections to this task. The first task is to encourage trainees to browse through the collection of CD-ROM titles and to form an idea what types of instructional materials are available for classroom instruction. In the other task, the trainees are required to critically evaluate the characteristics of a particular software title or Internet resource site as to the suitability of the materials for use in the classroom. Coupled with that activity, student teachers are required to design worksheets for pupils to use with the software.

Task 3: Micro-lessons. Applying visual design and learning principles, the student teachers working in pairs must develop a micro-lesson project using one of the multimedia presentation package. Micro-lessons, as the name implies, are small instructional materials that are specific enough for teachers to use within larger lessons. They are not intended to cover a whole lesson or section of the curriculum. Micro-lessons could be developed using any basic presentation software, for example, PowerPoint. Using the
enhanced features of PowerPoint97 (e.g. hyperlinks, animation, builds, etc.) micro-lessons can be developed which incorporate some simple but effective presentation techniques, and which can also permit a useful degree of interaction. Student teachers are encouraged to develop micro-lessons that are used as student self-instructional materials where the students themselves sit at the computer and engage in the materials.

**Task 4: Visual Support Materials.** The student teachers are required to prepare supporting materials for Task 3. Other forms of visual learning materials, such as posters, charts, web-pages, 3-D models can be designed.

**Task 5: New Technology.** There are two objectives behind this task. The first objective is for the student teachers to learn about new technological tools that can be applied in an educational setting. Another objective is to allow them to experience what constructivist learning is all about as they go about researching, evaluating and presenting the information that they have gathered.

**Results**

1. IT skills – Are the student teachers equipped with necessary IT skills before they commence the Instructional Technology module?

   As was stated earlier, we wanted to change from a skill-based course to a pedagogy-based course. However, it requires that we determine whether the student teachers have the necessary pre-requisite skills to move from skill-based to pedagogy-based curriculum. If not, we would have to provide supplementary help to the students to bring them to an acceptable level of competency. We wish to obtain information from students about their skills using word processing (Microsoft Word'97), and using a multimedia presentation package (Powerpoint97). But our data collecting methods needed to be constructed to effectively handle data from 1000 student teachers. To this end, a special web-page was designed for students teaches to respond to. Student teachers were told to log on to the special course home page and to sign up for the workshop or to excuse themselves from attending Basic IT skills workshops. They were given a self-assessed skill checklist to determine their own competency level. The table below shows the percentage of student teachers who were familiar with using the software, and who asked for exemption.

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<th>1994 (familiarity in using the software)</th>
<th>1998 (asked for exemption from attending workshops after taking a skill-checklist test)</th>
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<tr>
<td>Word processing</td>
<td>86%</td>
<td>90%</td>
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<tr>
<td>Multimedia presentation</td>
<td>6.4%</td>
<td>45%</td>
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There is a slight increase from the 1994 study in the percentage of students familiar with a word processing package. This was expected. In the next few years, with more IT initiatives launched in schools and in universities, we expect that nearly all student teachers will be familiar with using a word processing software even before they are admitted to NIE. In the use of multimedia presentation, there is a dramatic increase from 6.4% to 45% in the number of student teachers who are familiar with the multimedia presentation package. Considering that the present version of the software is more complicated with many added features, the high increase in fluency shows that student teachers have benefited from various IT programs conducted in schools, universities and in their workplace.
2. What are the student teachers' reaction to the New Technology task? How do they feel about it? Can this constructivist approach applicable in the school situation?

The trainees answered a post-activity questionnaire on how they feel about the new technology tasks. A four-point scale of 1 (strongly disagree) to 4 (strongly agree) was used.

a. Generally the student teachers were positive about this task. About 88% of the student teachers surveyed responded that the exercise of researching and presenting on the new technology would be useful to them as a teacher. They could see that the approach of planning, researching and presenting can be an activity format for students in the school. The results indicates that the student teachers were quite open to this form of instruction, and would be able to appreciate the value of this approach to their teaching.

b. About 85% of the student teachers preferred this mode of instruction rather than the traditional form of teaching where the lecturer alone presents the information. Possibly the different slant and presentation style of the student teachers added variety to the teaching mode. This is interesting, as the student teachers generally studied under the traditional directed-teaching styles of their teachers and yet they responded well to this alternative mode of instruction.

c. Nearly 88% of the students agreed that this exercise was a good example of constructivist method of learning and would recommend this mode to other cohorts of student teacher.

d. However, the student teachers felt that they spent more time on this project compared to others. This is not surprising because they needed time to research in the topics, as most of them had little or no knowledge of the topic.

e. The student teachers were also asked from where they obtained their information. The student teachers mentioned that they obtained 57% of their information from the Internet, 13% from books, 14% from magazines or newspapers, 8% from personal contacts outside campus, and 8% from friends within the campus. The students obtained their information mainly from the web because of the type of topics. As these topics are relatively new (new technology) it is quite hard to find them from the traditional sources like books or periodicals. Indirectly, by performing this instructional task, the student teachers acquired Internet skills.

Challenges Ahead

The Instructional Technology has just started to take a on new look in which the student teachers are involved in learning within a new technological environment. We have certain plans to make the course into one which uses more technology to deliver our course. We intend to change the traditional lecture-tutorial mode course into one which is self-learning, web-based and yet interactive with fellow student teachers and the teacher trainers.
References
Journal of Global Information Management, 6(1), 5-14.
Wong, P. & Williams, M.D. (1994). The "Intelligent Island": Are Singapore trainee teachers ready for it?

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<tr>
<th>IT Skills for Teachers</th>
<th>Processes</th>
<th>Strategies and observables</th>
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<tbody>
<tr>
<td>Acquisition</td>
<td>Acquiring Basic IT skills</td>
<td>Attend weekend / vacation IT workshops on word processing and presentation package. Computer hands-on classes during Saturdays and during the vacation periods</td>
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<tr>
<td></td>
<td>Acquiring Internet skills</td>
<td>Through work process when accessing Module home page and downloading various documents</td>
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<td>Exposure of new technological tools for instruction</td>
<td>Research and investigation on new IT tools and their applications to education. Student teachers will present their findings to the class.</td>
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<td>Application</td>
<td>Identifying and selecting resources for teaching</td>
<td>Browsing through a number of CD-ROM titles from library</td>
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<td></td>
<td>Evaluating resources and designing instructional activities</td>
<td>Using an evaluation tool to critically evaluate one CD-ROM title and to design instructional activities to accompany it.</td>
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<td></td>
<td>Pedagogical Concerns with Integrating IT into the lesson</td>
<td>Discussion and presentation of designed instructional activities.</td>
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<td>Instructional Models and Theories for applying IT to instruction</td>
<td>Self-instructional models and application of models</td>
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<tr>
<td>Innovation</td>
<td>Designing and developing multimedia materials</td>
<td>Applying visual design principles to create student-centered materials. Creating a micro-lesson project with rationale and justification on the pedagogical applications of the project.</td>
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<td>Developing support instructional materials</td>
<td>Develop activity sheets for pupils to use in conjunction with the student-centered materials developed</td>
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Table 1: Conceptual Framework for Instructional Technology module