

ICT and Pre-service Teacher Education: Towards an Integrated Approach

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As ICT is becoming an integral element for educational reforms and innovations in primary and secondary schools, this situation calls for an enhancement of pre-service education on ICT for prospective teachers. This paper focuses on issues relating to pre-service teacher education on ICT. Problems with existing approaches to pre-service training on ICT are first addressed. Cases that represent partial solutions to the existing problems are introduced. Based upon our own experiences in ICT training for pre-service and in-service teachers, an integrated curriculum for pre-service teacher education on ICT is proposed within the framework of cultures.

Keywords: ICT, pre-service teacher education, integrated approach, cultural perspective.

Abstract

As seen by us in today's universe of education, the use of ICT has caused substantial changes for learning. Firstly, the rich representations of information changes learners' perception and understanding of the world; secondly, the vast distribution and easy access of information has changed relationships between educators and learners; and thirdly, the flexibility of spatial and temporal dimensions in the cyberspace changes human beings' learning life. All of these changes evidence that ICT is becoming an integral element for educational reforms and innovations in current society, and our education is reaching an age of e-education.

Undoubtedly, ICT is bringing about new opportunities for educators, because it can provide powerful support for educational innovations. However, the use of ICT in education creates ever-new challenges for teachers. They need not only to learn the skills of using ICT, but also to learn how to design innovative instructions through an integration of ICT with curriculum. Reasonably, for undergraduate students who are prospective schoolteachers, they should be well prepared for using ICT in education. It has become a common sense that, for a pre-service teacher education program without an integration of ICT, it could not be said to be a complete one.

Introduction

Problems with current pre-service teacher education on ICT

In China, teacher universities undertake major responsibilities for fostering schoolteachers. To meet the challenge of e-education, these universities have made considerable efforts to reinforce the their students' ICT competence. Up to June 1999, more than 99 per cent of teacher universities have set computer education as a mandatory course, and about 76 per cent of universities have established ICT related departments¹.

The education program for undergraduate student who are prospective teachers traditionally consists of four main parts [Fig1 (a)]:

- Basic courses, which set up a common foundation for all students;
- Specialist courses, which build up respective knowledge bases for students of different specialties;
- Educational courses, which contribute to acquire educational theories for prospective teachers commonly;
- Educational practice, which usually takes place in the last year of study when the students go on probation in schools for 2 up to 4 months.

Since the 1990s, two clusters of technological courses started to add onto the curriculum of pre-service teacher education [Figure 1 (b)]. The first cluster falls into ICT basics, including modules such as computer basics, programming, software tools, and network applications; the second cluster is related to educational technology, including modules such as instructional media, computer-based instruction, and multimedia authoring.

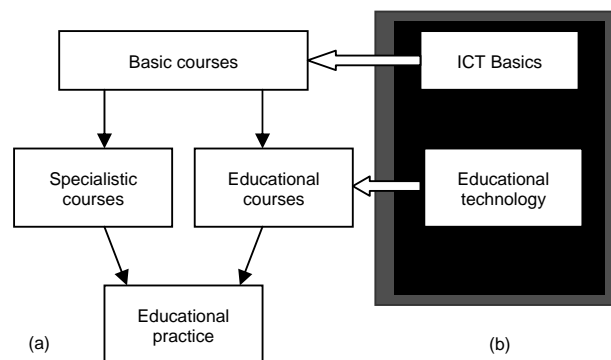


Figure 1. An “add-onto” approach for technology in pre-service teacher education

However, a number of problems have been found with such an “add-onto” approach for technological courses, because:

- The ICT basics are taught by teachers from computer sciences, thus only technical issues are focused, but nothing doing with pedagogical uses of technology;

- The courses of educational technology are taught in rather traditional ways and show few evidences of using new technology to support instructional innovations; and
- The students don't know how to use new technology in their classroom instruction when they go to probationary positions in schools, because they lack previous practices of applying ICT into curriculum.

As seen by us, in the current practice of pre-service teacher education, technology is taught in separation from the study of specialization, educational theories and educational practice as well. Undoubtedly, this situation will hinder the development of competence for prospective teachers in using ICT to support instructional innovations, as they will teach in the way as what they were taught.

With the recognition of problems with existing pre-service teacher education on ICT, we have been looking for better solutions in the past three years and have acquired considerable experience in pursuing an integrated approach for ICT education. Three cases are described below, which could be considered as a partial solution for problems described above.

In East China Normal University that we are working with, a training was founded in the first half year in 1999, which is dedicated to pre-service training on ICT for prospective teachers. The occupies a space of 2500 square meters, which contains multimedia classrooms, networked CAL labs, courseware development labs, media production , and microteaching labs as well. The facilities of this can afford instructional and practical activities for 300 students simultaneously. Ten training modules have been developed by the , including Basics of computer and Network Applications, Courseware Design, Multimedia authoring, Distance Learning, Instructional design and practice, and so on. Students receive two phases of training. In the first phase, they learn the methods of using ICT in education through hands-on practices associated with study of modern pedagogical theories. In the second phase, they do authentic pedagogical practices in microteaching labs in combination with their educational probation in schools. This approach creates a good linkage between technological learning and pedagogical practice. By the end of November 2001, more than 2500 students from local teacher universities have accepted training. A student from Biological Department of ECNU said after training, "This training taught me a lot of knowledge about ICT and its uses in education. It make me become more confident when going to teach in school"². In China, this type of training s can also be found in other teacher universities, such as Beijing Normal University (BNU), Nanjing Normal University (NNU), South-China Normal University (SCNU), and so on.

Towards an integrated approach

Establishment of learning technology training

To some extent, these activities embody essential elements composing innovative instructional processes, including research-based learning, resource-based learning, collaborative learning, and performance-oriented evaluation. We believe that learner who acquired innovative experience during the training process would transfer these innovative elements into their own teaching practice.

Theoretical lectures: This part includes 8 lectures; each lecture either introduces new perspectives regarding the use of ICT in education, or addresses innovative learning models with support of new technologies, or discusses methodological points critical to the design of creative learning systems.

Support Materials: This part collects a set of tools, including lesson templates, lesson plan samples, students e-work samples, and evaluation rubrics, which are designed to scaffold different practical activities.

As illustrated by Figure 3, this curriculum makes a better integration between theories, technologies, and pedagogics.

Theories (lectures)	Pedagogics (Activities)	Technologies (Tools)
<ul style="list-style-type: none"> Learning theories Media and instructional issues Learning resources Instructional process Instructional design ICT and instructional innovations Evaluation technology 	<ul style="list-style-type: none"> Studying theories Searching information Discussion issues Designing lesson plan Creating e-works Self/peer evaluation Communication/publishing 	<ul style="list-style-type: none"> PowerPoint IE Explorer; Search Engine E-mail BBS Chat Room Word Publisher

Figure 3. An integration of theories, pedagogics and technologies

One of our recent practices on pre-service ICT training is the adoption and adaptation of the Intel-Teach-to-the-Future (ITF) teacher-training curriculum. Funded by Intel Corporation, the ITF project represents an international effort that through training to enhance schoolteachers' competence for using ICT in their classrooms. The goal of the curriculum is to train classroom teachers how to promote inquiry-based learning and effectively integrate the use of computers into their existing curriculum so that the students will increase their learning and achievement. Starting from 2000, over 18 thousand school teachers have been trained in China.

The IFT training curriculum was developed for in-service school teachers. We are exploring the possibility to adapt the curriculum for pre-service training. As a pilot, 40 students from Zhejiang Normal University took part in 4-days of training using the IFT curriculum of a slight adaptation. The feedbacks from trainees show that all of participants considered this training useful and valuable. Through the training, participants not only got to know the operation of technology, but also deeply realized that effective integration of ICT into instruction would enhance learning effect and high-level thinking

Adoption and adaptation of international training curriculum

ability. As a result, these participants know more about the ideas of technology-supported instructional innovations, and can design lesson plans demonstrating a good integration of technology.

Summary of our experiences

Our experiences in pursuing an integrated approach to pre-service teacher education on ICT could be summarized as follows:

- Integrating in-campus training on ICT and field practice (on probation).
- Integrating theoretical learning and pedagogical practices. It is of importance that theories should be learned in the context of practice.
- Integrating hands-on and minds-on, that is, learning by doing in combination with mental activities such as brainstorming, group sharing, and peer evaluation, and self-reflection.
- Training for transfer, that is, the process of training should be ICT-supported and integrated elements of instructional innovations as more as possible, so that the student trainees will be able to use these elements in designing their own instructional process later.

Integrated curriculum with a cultural perspective

Based upon our already acquired experiences in pre-service and in-serve education on ICT, we are considering the possibility to develop an integrated curriculum, which is aimed at accomplishing three “integrations”:

1. Integration of learning ICT in general and applying ICT in education.
2. Integration of theories, pedagogics and technologies within the framework of learning cultures.
3. Integration of multiple publishing media.

1. Integration of learning ICT in general and applying ICT in education

The curriculum will include five categories of knowledge as illustrated by Table 1.

Table 1. Knowledge in categories contained in the integrated curriculum

Main topic	Contents
What is ICT in general?	Information tools, productivity tools, communication tools, problem-solving and decision making tools ⁵
Why use ICT in education	Knowledge race, educational reforms, life-long learning
How to use ICT in classroom instruction	Presentation, practice, testing, inquiry, cooperative learning
How to use ICT for personal and professional developments	Distance learning, research, academic productivity
Safe and ethical use of ICT in education and in general	Content filtering, acceptable use policy, fair use of e-resources in education, anti-virus,

2. Integration of theories, pedagogics and technologies within the framework of learning cultures

In the age of information, as quite a lot of learning activities take pace in a single cyberspace of zero distance, thus different learning cultures will meet together. The first author of this paper suggested a two-dimensional model for a classification of learning cultures, which identifies four different types of learning models: individualism-objectivism, individualism-constructivism, collectivism-objectivism, and collectivism-constructivism⁶. As shown by Figure 4, he also tried to link most of existing ICT-supported learning models to particular learning cultures⁷.

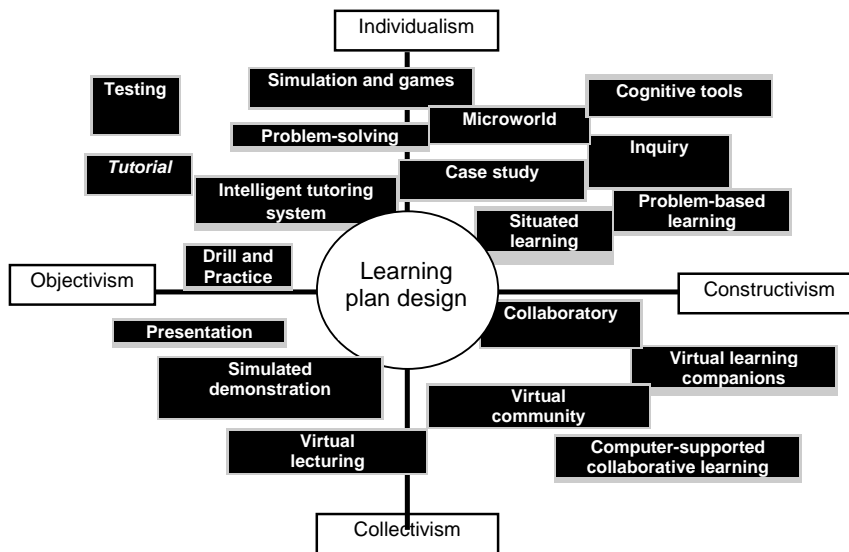


Figure 4. A cultural classification of ICT-supported learning models

We believe that each type of learning models has its specific value for the development of learners' competence. Therefore, prospective teachers should learn to make a comprehensive use of different learning models. They need to know learning theories underlying each type of cultures; they should be clear what pedagogical models are linked to each culture; and they must be able to use suitable technologies to support a specific pedagogical model. With these considerations in mind, we suggest a knowledge profile for each type of learning cultures as shown by Table 2. In the column of technologies, the items of italics represent selective tools when teaching.

Table 2. Knowledge profile in terms of learning cultures

Learning cultures	Theories (of learning and instruction)	Pedagogics (Learning models)	Technologies (Tools)
Objectivism-Individualism	<ul style="list-style-type: none"> • Programmed Instruction • Taxonomy of educational objectives • Component display theory 	<ul style="list-style-type: none"> • Tutorial • Drill & Practice • Testing • Simulation 	<ul style="list-style-type: none"> • Multimedia authoring • CMI system • <i>Adaptive learning technology</i>
Objectivism-Collectivism	<ul style="list-style-type: none"> • Taxonomy of educational objectives • Reception learning theory • Instructional design theory (e.g., Gagne's) 	<ul style="list-style-type: none"> • Presentation • Virtual lecturing • Simulated demo 	<ul style="list-style-type: none"> • PowerPoint • <i>Virtual reality</i> • Grouping tools
Constructivism-Individualism	<ul style="list-style-type: none"> • Cognitive development theory • Discovery learning theory • Cognitive flexibility theory 	<ul style="list-style-type: none"> • Microworld • Inquiry • Case study • Situated learning • Problem-based learning 	<ul style="list-style-type: none"> • Hypertext/hypermedia • Search engine • <i>Spreadsheet</i> • Word/PowerPoint • <i>Publisher</i> • E-mail • Portfolio
Objectivism-Collectivism	<ul style="list-style-type: none"> • Social constructivism • Cooperative learning theory 	<ul style="list-style-type: none"> • Computer-supported collaborative learning • Virtual learning companions • Virtual learning community • Collaboratory 	<ul style="list-style-type: none"> • BBS/ Chat • <i>MUD/MOO</i> • Database • <i>Groupware</i> • <i>Agent</i> • Evaluation rubric
Integration of learning cultures	<ul style="list-style-type: none"> • System theory • Knowledge ecology 	<ul style="list-style-type: none"> • Learning plan design 	<ul style="list-style-type: none"> • Learning plan templates • Learning management system

3. Integration of multiple publishing media

The contents of the curriculum will be organized into three parts:

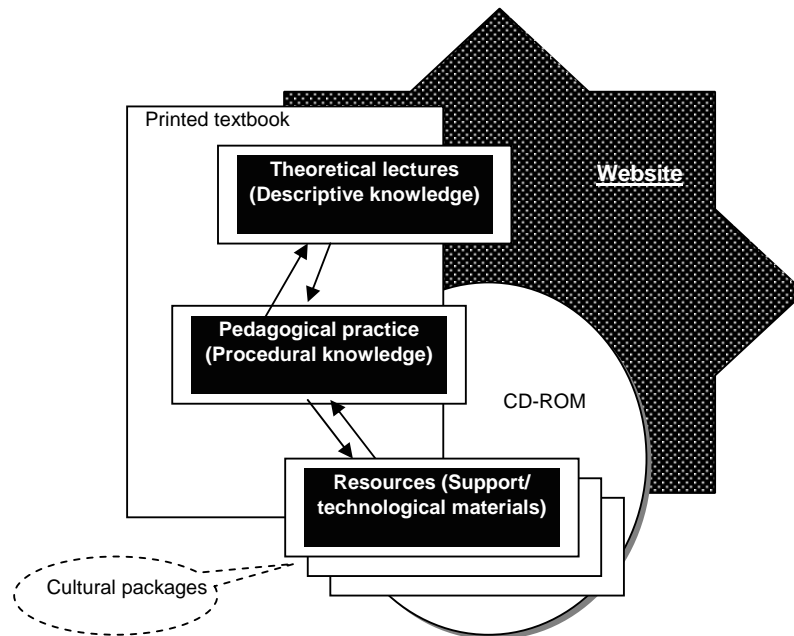


Figure 5. Media profile of the curriculum

- Pedagogical practices, which contain procedural knowledge prescribing learning activities for training participants with reference to theoretical lectures and resources in context.
- Theoretical lectures, which contain descriptive knowledge introducing learning theories and instructional design theories in topics.
- Resources, which contain support materials and technological tools serving for pedagogical practices. When the curriculum is intended to be used in different cultural zones, it is important to create culturally-different materials such as unit plan samples, student s' e-work samples, and multimedia stuffs, which can be called *cultural packages*.

Three different types of media will be used simultaneously (Figure 5):

- Printed book, which is used to record major parts of theoretical lectures and pedagogical practices as well as a minor part of the resources.
- CD-ROM, which is used to record major part of the resources.
- Website, which is used to contain extensive parts of the theoretical lectures and the resources.

We would like to share experiences with international colleagues.

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