

# Preparing Student Teachers to Use ICT at Secondary School: A Course Designed at the University of Zuerich \*

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**Abstract:** Our two-semester course has been developed over several years. We specifically try to prepare student teachers to use information and communication technology (ICT) in their future work in the classroom. Thereby we are faced with three major difficulties: – the broad spectrum of subjects students have studied and will teach, – differences in the pre-knowledge and the pre-skills students bring with them, – most students have gained their own learning experience in classic lecture situations which are not compatible with a technology-oriented context. This paper will show how we try to overcome those difficulties. Our current course design is based on a learner-centered approach and combines different learning styles. In the first semester, our students work in independent groups following a guideline sheet. During the second semester, students create their own projects where they integrate ICT into classroom situations.

## Introduction

Compared to America and most European countries Switzerland is very small. It has less than 3% of the inhabitants of the USA yet is composed of 26 cantons, which are autonomous concerning schooling. Hence many different school systems exist. However, we will only consider the situation of the canton of Zuerich in the north-eastern German-speaking part of the country. Secondary school are of two types. Most students (nearly 80%) attend normal secondary schools and after 9th grade leave school and start an apprenticeship. Only the remaining 20% go to grammar school and after the 12th grade will pass the final examination (called "Matura" in German), which is required to enter university. The following paper deals only with pre-service education of grammar school teachers. They have to acquire a first degree; afterwards they go through teacher education, which also takes place at the university. As a result, grammar school teachers teach only one, possibly two, subjects. Our two-semester course has been developed over several years and we have continued to adapt it to correspond to the evolving situation in information and communication technology (ICT). Because of restricted resources, our course is not compulsory, but optional to the students.

## Concept

The goal of the course is to prepare students to use computers and communication technology in their future work in the classroom. This is not an easy task. Reports and our own experience show that ICT is not commonly used in grammar schools. For the novice teacher, there are many obstacles. Teaching itself is difficult and must be learned through practice. Due to their own lack of teaching experience, novice teachers tend to use the experience they gained in earlier situations as learners. In the technology context, experience from a learner perspective rarely exists. Furthermore, working with computers on a personal basis and embedding technology in a classroom setting are two totally different tasks. There are considerable differences concerning pre-knowledge and the pre-skills in relation to ICT among the participants in our course. The ability to use technology is a pre-requisite but not a guarantee for effective action in the classroom. Experts in this field refer to typical examples, but there is rarely agreement on the best way to apply technology-based teaching. A very important point is the following: The participants of our course have studied, and will teach different subjects: Languages (German, French, English, Italian, Spanish, Latin), History, Mathematics, Physics, Chemistry, Biology and Geography. The questions arising in the teaching of English for example or Mathematics using ICT are really different. All in all, teaching such a course is a well-nigh impossible task. However, a heterogenous audience may also have positive effects (Moser 1999).

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Summarizing the facts we have to deal with three major difficulties in designing our course:

- the participants will teach different subjects
- the participants have different pre-skills in the use of ICT
- the participants have no teaching experience, nor can they activate relevant learner experience.

An obvious strategy to overcome the difficulties is to individualize the learning process. This means a decomposition of the course: Students work individually on their own tasks. This is quite natural in a computer context, because this machine is tailored for individual use, having only one keyboard and one mouse. Nowadays however, it is widely accepted that learning also has a social dimension and that the learning process may be influenced positively by cooperation. There is currently interesting research being done on this subject (see for example Dillenbourg P. 1999). Bringing the two concepts together results in groups of learners. The size and the composition of such a group is of course critical. During the first session we normally let the students form learner groups composed of two to four participants teaching the same or a similar subject. The differences in pre-skills may also be evened out in such groups. This difficulty can, however, not be completely resolved. Cooperation in the groups and imposing the focus on didactical reflections reduces this difficulty. The third problem is the most difficult to overcome in a university framework. The best thing would be to give the students the possibility to observe lessons and to conduct their own teaching experiments. We are able to do this to a very limited extent; external constraints do not allow more. As mentioned earlier, novice teachers use their learner experience as a resource in their own teaching activity. Therefore, in our course we try to prepare learning arrangements, which build up the experiences of the students, and we try to give concepts which they can copy later in their own classrooms. Our intention is a kind of "hidden curriculum". This may be explained easily by the famous saying: "Teachers teach as they were taught, not as they were taught to teach." By individualizing the learning process, we observe another slogan: "self-directed learning". This is an essential point in every learning process: To what extent is the learner guided from the outside and what part does he manage by himself. There is a continuum of possibilities from leading by the nose to not being guided. It is an art to find the right balance for every audience. We are convinced that in most cases guidelines are needed to produce an efficient learning environment. Within an carefully fixed framework the participants of our courses have the liberty to create their own learning path.

## **Basic Course in Detail**

In the first semester of our course (called "Grundkurs" in German) the student acquires an overview, basic techniques and basic knowledge. During this semester there are about fourteen sessions. Five of them, spread out over the semester, are plenum events where demonstrations, talks and other input are combined with group activities. The other sessions are arranged by the learner groups. A task sheet (called "Semesterpass" in German) describes the work to be done as structured in the following sections:

- A organization and tools
- B telecommunication
- C software for learner (tutorials, simulations, etc.)
- D application software
- E authoring software
- F articles, books, videos
- G practice
- H portfolio

## Semesterpass

von .....

<b>A Kursorganisation, Werkzeuge</b>	
Ich habe ...	
... die Erklärung unterschrieben und der Kursleitung abgegeben	<input type="checkbox"/>
... mich einer Lerngruppe angeschlossen	<input type="checkbox"/>
... die Informationsblätter durchgelesen:	
Typenblatt	<input type="checkbox"/>
Forum	<input type="checkbox"/>
Umgang mit Internet im Kurs	<input type="checkbox"/>
... die Arbeitsblätter durchgearbeitet:	
Computerräume	<input type="checkbox"/>
WWW / e-Mail	<input type="checkbox"/>
<b>B Telekommunikation</b>	
Ich habe ...	
... das Arbeitsblatt "Internet" durchgearbeitet	<input type="checkbox"/>
... die durch das Impulsreferat aufgeworfenen Fragen geklärt	<input type="checkbox"/>
... an folgenden Wettbewerben teilgenommen	
Daten: ... ..	
<b>C Lernprogramme</b>	
① Pflichtbereich	
Ich habe ...	
... den Pflichtbereich des Arbeitsplans durchgearbeitet	<input type="checkbox"/>
... die durch das Impulsreferat "Modellbildung und Simulation" aufgeworfenen Fragen geklärt	<input type="checkbox"/>
② Zusatzbereich	
Ich habe den Zusatzbereich des Arbeitsplans durchgearbeitet	
<input type="checkbox"/>	
<b>D Anwendersoftware</b>	
Es ist nicht die Absicht, dass Sie in diesem Bereich sämtliche Arbeitsblätter vollständig durcharbeiten. Vielmehr sollen Sie zuerst den Stand Ihrer Fähigkeiten bestimmen und davon ausgehend Ihre Fertigkeiten um eine Stufe erweitern.	
Ich habe ...	
... im Bereich Textverarbeitung/Graphik den Stand meiner Fähigkeiten bestimmt und um eine Stufe erweitert	<input type="checkbox"/>
... im Bereich Datenbanken den Stand meiner Fähigkeiten bestimmt und um eine Stufe erweitert	<input type="checkbox"/>
... im Bereich Tabellenkalkulation den Stand meiner Fähigkeiten bestimmt und um eine Stufe erweitert	<input type="checkbox"/>
... mit meiner Lerngruppe fünf Unterrichtsbeispiele für unseren Fachbereich gesucht und in mein Portfolio abgelegt.	<input type="checkbox"/>

Figure 1: Part of the task sheet

A booklet (called "Arbeitsheft" in German) contains the necessary worksheets, guides and schemes organized in the same sections as the task sheet. Additional information can be found on our webpage (<http://www.unizh.ch/hlm/ascifu/index.html>) and additional material, for example software or videos, must be ordered by electronic mail. The learner group has to plan its activities at the beginning of the semester and report them to the professor responsible. Most communication is conducted by electronic mail. Search competitions on the internet aim to improve the search skills and the regularity of e-mail use of the participants. A panel discussion with active teachers and visits to schools give an insight into classroom reality. The progress of the group is supervised by the professor responsible in periodical conversations. As an example, let us take a closer look at section C, where a special scheme presents the tasks required. A software tutorial introduces the students to the features of tutorial- and drill programs. Learning software of their choice, ordered by mail, must be tested and evaluated by the groups. Leading questions are – what are the benefits of this software? – can the task also be fulfilled without technology? The findings and the evaluation must be reported to the supervising professor.

Universität Zürich, Hörsaal Lehrstuhl Methodik der Informatik in der Mittelschule ©

**Lernprogramme: Arbeitsplan**

**Ziele:**

- Einblick nehmen in die Möglichkeiten der Verwendung von Lernprogrammen im Unterricht
- Erwerben von Wissen über Aufbau, Struktur und Funktion von Lernprogrammen
- Kennenlernen von Lernprogrammen und Reflexion über deren Einsatzmöglichkeiten im Unterricht
- Thematisieren von methodischen Aspekten des computerunterstützten Unterrichts

**Pflichtbereich:**

Was	Soz. form	Material	Rückmeldung	Datum
Übersicht über die Programmtypen studieren	EA	Typenblatt		
Tutorial über Tutorials und Übungsprogramme durcharbeiten und Leitfragen beantworten (zeitliche Diskette bei den Dozenten verlangen)	EA/GA	Programme, Leitfragen	Lerngruppe	
5 Programme für ihr Fachgebiet aussuchen und kennenlernen, mindestens eines pro Kategorie nach Blatt "Programmtypen". (Programmliste: <a href="http://www.inzh.ch/lin/ASIAS/Prog5.html">http://www.inzh.ch/lin/ASIAS/Prog5.html</a> , Bestellung per E-Mail an den betreuenden Dozenten) In der Lerngruppe über die Einsatzmöglichkeiten dieser Programme nachdenken und für jedes Programm ein Evaluationsblatt ausfüllen. Diese sollen nach Möglichkeit mit einem Kursleiter besprochen werden	GA	Programme, Evaluationsblatt	Evaluationsblatt Kursleitung	
Blatt "Lernprogramme im Internet" durcharbeiten	GA	Arbeitsblatt	E-Mail	
Eine Liste von Lernprogrammen, die für ihr Unterrichtsfach angeboten werden, zusammenstellen	GA	Kataloge Internet Zeitschriften	Portfolio	

EA Einzelarbeit, PA Partnerarbeit, GA Gruppenarbeit

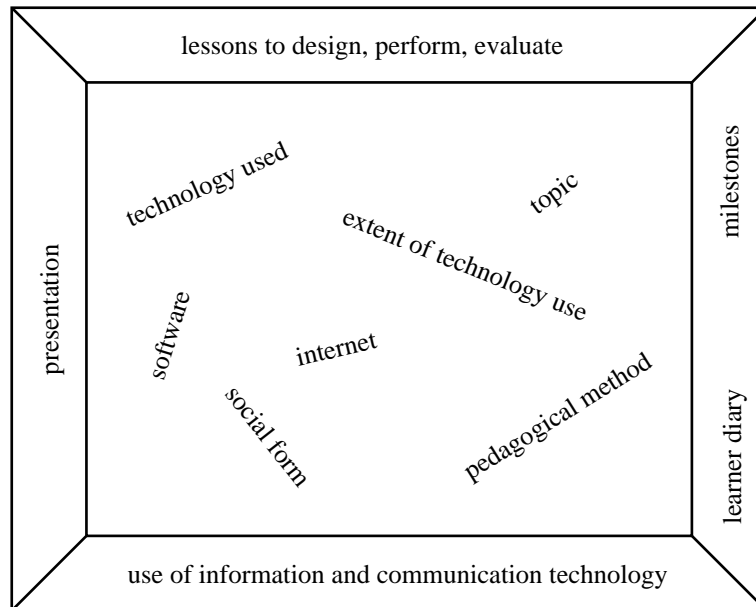
Figure 2: Part of the scheme (section C)

## Project Course in Detail

During the second semester of our course (called "Projektkurs" in German) the student applies the knowledge and skills gathered to a classroom situation. The goal is to develop, perform and evaluate lessons in the specific subject whereby ICT must be imbedded. Again students of the same subject work together in groups to carry out this task. Possible interdisciplinary cooperation is encouraged of course. Often groups formed in the proceeding semester continue working together. The course is arranged as a pedagogical project. There are different definitions of such a project and we will therefore outline our concept, which is based on a description of Bruggmann (1992). The framework is given by the following facts:

- lessons must be designed, performed and evaluated
- at the end of the semester the results must be presented to the plenum
- during the lessons information and communication technology must be used
- milestones and a learner diary will accompany in parallel to the process

Besides these obligatory conditions, the groups are free to design their project. This means that decisions concerning the number of lessons, the topic, the technology used (internet, software, etc), to what extent the technology is used, the pedagogical methods and the social form are made by the group. We have a database with addresses of teachers who have agreed to place a class at our disposal. However, the groups themselves have to arrange the necessary cooperation. The most difficult aspect in projects is time management. As already mentioned, we emphasize the idea of guidelines and we shall now describe how we realized this in the project part of our course. The members of a group have to sign an agreement fixing in advance the topic and plan of realization. This should help to set realistic objectives, and is done in cooperation with the supervising professor. Secondly, each participant writes a learner diary and has to discuss it with the professor responsible. In particular we point out the metacognition aspect. Students dislike writing diaries during the process, but describe it afterwards as a very useful tool. The milestones are the third way in which to guide a project: The group regularly has to present the progress made in the project, the problems encountered, the support needed as well as the modification in project goals.



**Figure 3:** Framework of our pedagogical projects

## Conclusion

As the development of technology progresses, course design and teaching material must be continuously adapted. Three years ago, we published a concept for cheap and efficient in-service teacher training (Kuster et al. 1996). We have recently been able to transpose this, starting with teachers of two subjects. There are plans to make connections between these two areas: On the one hand bringing together experienced teachers, and on the other, the less experienced students. There could be mutual benefit in such exchange. Moreover, we have started to use groupware tools, which will be useful in the project part of the course and in in-service teacher training. Many articles discuss pre-service teacher training in the area of ICT (see for example Murphy and Greenwood 1998). Our efforts to focus on technology and on teaching style, and to offer student teachers excellent learning arrangements to enrich their own experience has proved very successful.

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