OECD/CERI ICT PROGRAMME

A Case Study of ICT and School Improvement

Austria

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Peter Baumgartner, Univ.Prof. Dr.

Hermann Denz, A.Prof. Dr.

Irmgard Oberhauser, Mag.

Kurt Hoffmann, Mag. Ing.

University of Innsbuck Austria

Table of Contents

1 The project			
	1.1 F	Focus of research	1
	1.2 I	Data collection	3
	1.3 7	The Austrian sample	3
r	The	ahoola	5
2 The schools			, 5
	2.1 F) /
2.1.1		Secondary School of Grein	с -
	2.1.2	Secondary School of Wien-Kinkplatz	7
	2.1.3	Secondary School of Wien-Steinbauergasse	3
	2.1.4	Secondary School of Hall)
	2.1.5	Secondary School of Graz-Webling10)
	2.2	Case studies	1
	2.2.1	Secondary School of Grein12	2
	2.2.2	Secondary School of Wien-Kinkplatz	9
	2.2.3	Secondary School of Wien-Steinbauergasse	1
	2.2.4	Secondary School of Hall86	5
	2.2.5	Secondary School of Graz-Webling109	9
3 Conclusions		usions	5
	3.1 7	The beginning of ICT in schools135	5
	3.2 1	The status quo	5
	3.3 H	Typotheses	7
	3.3.1	Hypothesis 1137	7
	3.3.2	Hypothesis 2137	7
	3.3.3	Hypothesis 3138	3
	3.3.4	Hypothesis 4	3
	3.3.5	Hypothesis 5139	9
	3.4 0	Challenges for the future	9

1 The project

This study has three goals. The first is to examine the different ways that ICT relates to school innovation and improvement, and under what conditions it functions as a catalyst for educational innovation and improvement. The second goal is to uncover the critical variables that relate to successful implementation of school improvements and effective ICT. The third goal is to detect undesirable impacts of ICT on how schools function and student learn (see workbook: 1).

On the one hand, this study should provide helpful and necessary information and show the main indicators of success of school improvements for policy makers in our education system. On the other hand, this report should help to establish a successful schoolmodel for other sites. We examine the study goals using the example of five successful ICT secondary schools.

The entire project is posted on the Web (www.project.uibk.ac.at/oecd) and will be updated regularly by the research team. The five hypotheses on which this study is based will be presented in the next chapter (see workbook: 2f).

1.1 Focus of research

The first hypothesis is the central focus of this project; the other four define the environment through additional questions.

1. Technology is a strong catalyst for educational innovation and improvement, especially when the World Wide Web is involved. The rival hypothesis is that where true school-wide improvement is found, technology served only as an ad-

ditional resource and not as a catalyst, that the forces that drove the improvements also drove the application of technology to specific educational problems.

- 2. The diffusion of the innovation/improvement (and therefore of ICT) followed the traditional diffusion pattern for innovations, as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and that therefore different diffusion patterns occur.
- 3. Successful implementation of ICT depends mostly upon staff competence in the integration of ICT into instruction and learning. This hypothesis assumes that teachers mediate ICT applications when they are successful, and that ICT's academic value relates positively to teacher competence. The rival hypothesis is that the school technological infrastructure and student ICT competence rather than staff competence determine ICT implementation outcomes.
- 4. Gaps in academic performance between high and low poverty students will not increase when all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to more advantaged students increasing the performance gap with disadvantaged (high poverty) students.
- 5. Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

1.2 Data collection

The OECD determined the volume and type of data to be collected in order to derive convergent evidence (see workbook: 4).

- 1. Interviews with teachers, administrators, students, parents, and technology specialists.
- 2. Observations of school functioning.
- 3. Collection of student and teacher work, school newsletters, plans, and the like.
- 4. Survey of teacher ICT practices.
- 5. Examination of electronic materials and of responses to e-mail.
- 6. Interviews with knowledgeable people outside of the school: inspectors, principals of feeder and feed-to schools, partners, community members, et al.

1.3 The Austrian sample

We used a three-step sampling technique to get the sites for our research:

- 1. In a first step, we asked the school administration of each federal province (Landesschulrat) to send us a list of schools with a focus on ICT. We got this list from most of the administrations.
- 2. In a second step we checked this list: We dropped schools which had no homepage, and we used school rankings to verify information about the schools. We sorted the schools into theoretical clusters according a classification based on the region and the size of the community. In Vienna we also divided schools into areas with a high proportion of working-class people and high proportion of middle-class people.
- 3. In the third step we contacted the schools. Some schools declined to participate because of the time and expense involved (one week with interviews and questionnaires), but we also found schools with a very cooperative staff.

The result was the following scheme with five sites:

		Size of the community			
		Small	Medium-sized	Large	
	North	Grein			
_	South		Graz		
Region	East			Vienna (middle class and work- ing class)	
	West	Hall			

More detailed information about the elected schools:

Name of the school	Address	Homepage	E-mail address
Hauptschule Grein	Groissgraben 2 4360 Grein	http://hitgrein.eduhi. at	hsgrein.direktion@eduhi.at
Informatik- hauptschule Wien Steinbauergasse	Steinbauergasse 27 1120 Wien	http://www.schulen. -wien.at/schulen/- 912062/	hs12stei027k@m56ssr.wien.at
Informatik- hauptschule Wien Kinkplatz	Kinkplatz 21 1140 Wien	http://www.schulen. -wien.at/schulen/- 914042/index.html	hs14kink021k2@m56ssr.wien.at
Europahauptschule Hall	Bachlechnerstrasse 2 6060 Hall in Tirol	http://www.euhs- hall.tsn.at/	direktion@euhs-hall.tsn.at w.willburger@tsn.at
Haupt- und Real- schule Graz-Webling	Unterer Bründlweg 19 8053 Graz	http://www.rs- graz.asn-graz.ac.at	direktion@rs-graz.asn-graz.ac.at direktion@rs-graz.asn-graz.ac.at

2 The schools

This chapter is divided into two parts. The first part consists of short abstracts in English and German from each of the schools investigated. The second part, "Case studies", provides a full report on each school. The reports are structured according to the instructions of the OECD (see workbook: 18f).

2.1 Abstracts

- Secondary School of Grein (Upper Austria)
- Secondary School of Wien-Kinkplatz (Vienna)
- Secondary School of Wien-Steinbauergasse (Vienna)
- Secondary School of Hall (Tyrol)
- Secondary School of Graz-Webling (Styria)

2.1.1 Secondary School of Grein

The secondary school of Grein decided for several reasons to install a school approach in ICT: because ICT-education is a modern trend, because they wanted to stop the decrease in the number of students, and because they wanted to increase the level of students' performance. The attractiveness of this ICT main emphasis is already recognizable in the first year. The enrolments for the ICT-class show an above-average increase. Whether the level of students' performance in general could be increased will be answered in three years, when the first ICT class graduates. Many difficulties are connected with the installation of an ICT school approach in Austria. For example: The teachers have to be trained in several ICT-subjects, but the demand for ICT-training far exceeds the availability.

Die Hauptschule Grein hat aus mehreren Gründen beschlossen, einen Schwerpunkt in IKT zu bilden: Einerseits weil der Trend in Richtung IKT geht, weil die Schülerzahlen ohne Schwerpunkt zu sinken drohen und das Ausbildungsniveau der Hauptschule gesteigert werden soll. Die Attraktivität des IKT-Schwerpunktes ist schon im ersten Jahr deutlich erkennbar. Die Anmeldungen für die IKT-Klasse sind überdurchschnittlich angestiegen. Ob das Ausbildungsniveau dadurch generell gesteigert wird, kann erst in drei Jahren beurteilt werden, wenn die ersten Absolventen der IKT-Klasse von der Schule abgehen. Einen IKT-Schwerpunkt in der Hauptschule einzuführen, ist in Österreich mit einigen Schwierigkeiten verbunden: Ein Beispiel: Die LehrerInnen müssen entsprechend ausgebildet werden, die Nachfrage nach EDV-Kursen übersteigt aber um ein Vielfaches das Angebot.

2.1.2 Secondary School of Wien-Kinkplatz

At the Kinkplatz secondary school, ICT is more than a main emphasis. Those responsible try to use ICT as an integral part of all subjects. The education goal is to facilitate the students' use of the new media: They should learn and be able to use the basic functions of the PC and the Internet. The secondary school of Kinkplatz has had ICT as its main emphasis for more than 10 years. Nevertheless the school administration and the teachers are still struggling with all kind of problems. Technical malfunctions are frequent, there is an urgent and ongoing search for qualified IT teachers, and structural conditions handicap quick and efficient action.

In der Hauptschule Kinkplatz stellt die Informatik nicht einfach nur einen Schwerpunkt dar. Sondern hier versuchen die Verantwortlichen, Informatik als integrierender Bestandteil in allen Unterrichtsgegenständen einzusetzen. Das Ausbildungsziel besteht darin, den SchülerInnen den Umgang mit den neuen Medien zu erleichtern. Sie sollen grundlegende Funktionen der PC- und Internet-Anwendungen kennen lernen und anwenden können. Die Hauptschule Kinkplatz wird seit über 10 Jahren als Informatik-Hauptschule geführt und trotzdem kämpfen die Schulleitung und die LehrerInnen immer noch mit Problemen aller Art. Technische Schwierigkeiten stehen an der Tagesordnung, qualifizierte IT-LehrerInnen werden dringend gesucht, strukturelle Gegebenheiten behindern schnelles und effizientes Handeln.

2.1.3 Secondary School of Wien-Steinbauergasse

Steinbauergasse secondary school was the last one of 14 secondary schools in Vienna, which decided together to become a secondary school focussing information technologies. The goal for the teachers is to prepare students for skills which they'll need in their future jobs. One leading idea is to offer students an access to modern information and communication technologies without them having necessarily their own equipment at home. Besides this focus, students with special needs are co-educated with regular students. The model of an "open schools" implies full time support by offering lunch, homework assistance and arrangement of leisure time activities from 12.00 to 5.30 p.m. for children where both parents are working or who come from broken homes.

Die Informatikhauptschule Steinbauergasse war eine der letzten Hauptschulen, die sich Anfang der 90er-Jahre entschloss, gemeinsam mit 13 anderen Hauptschulen Wiens den Schwerpunkt Informatik einzuführen. Das Ziel der Lehrpersonen ist es, den Schülern zukunftsorientierte Fertigkeiten für ihr späteres Berufsleben zu vermitteln. Ein Leitgedanke ist, Schülern aus meist sozial schwächeren Schichten den Zugang zu modernen Medien der Informations- und Kommunikationstechnologien zu ermöglichen, ohne dabei selbst ein Gerät zu Hause besitzen zu müssen. Neben diesem Schwerpunkt bietet die Schule auch behinderten Kindern Unterricht in integrierten Klassen an. Im Rahmen der "offenen Schule" wird SchülerInnen ein Mittagessen und Nachmittagsbetreuung mit Hilfestellung bei der Hausübung und Freizeitgestaltung geboten.

2.1.4 Secondary School of Hall

In the past, the European Secondary School of Hall conducted two classes with a language emphasis and a third class as a "normal" class without any emphasis. The main problem was the bad reputation of the "normal" class, which handicapped students and teachers. The principal and a small team of teachers decided to establish a new ICT emphasis starting in 1999/2000 in order to increase the value of the "normal" class. A further goal is to provide students with the ICT skills the economy and advanced schools expect them to have. The newly-established ICT emphasis has attracted many students, and two consequences were noticeable at the beginning of the 2000/2001 school year. Firstly, some of the students who applied for this ICT emphasis were toying with the idea of attending the neighboring high school. Secondly, more students applied for ICT than for languages emphasis.

Die Europahauptschule Hall führte früher zwei Klassen mit einem Sprachenschwerpunkt und die dritte Klasse wurde als "normale" Klasse ohne Schwerpunkt geführt. Das Hautproblem war der schlechte Ruf dieser "normalen" Klasse, der Lehrer wie auch Schüler im Lernen beeinträchtigte. Der Direktor und ein kleines Team von Lehrern entschlossen sich, einen neuen IKT-Schwerpunkt mit Beginn des Schuljahres 1999 einzuführen, der dazu beitragen soll, den Ruf der "normalen" Klasse zu verbessern. Ein weiteres Ziel besteht darin, den Erwartungen der Wirtschaft und der weiterführenden Schulen betreffend IKT zu entsprechen. Der neu eingerichtete IKT-Schwerpunkt begeistert viele Schüler und zwei Konsequenzen sind mit Beginn des Schuljahres 2000/2001 spürbar. Erstens haben sich einige Schüler für den IKT-Schwerpunkt angemeldet, die ursprünglich ins Gymnasium wechseln wollten. Zweitens haben sich mehr Schüler für den IKT-Schwerpunkt als für den Sprachenschwerpunkt angemeldet.

2.1.5 Secondary School of Graz-Webling

Webling secondary school, located in the southwest of Graz, the second largest town in Austria, is a school with six grades for students from the age of ten onward. During these six years of education the students are as efficiently as possible prepared for their future jobs as skilled workers. At the end of this school a final examination, "mittlere Reife", can be taken (corresponding to GCSE, ordinary level). At the same time this kind of school, which can only be found in Styria, was set up, information- and communication technologies (ICT) were introduced at this spezial school site in order to prepare the students for skills needed in their future jobs. This happened more than ten years ago. Webling secondary modern school was the first one in Austria which had a web site. Numerous projects including ICT have been carried out and project teams could win some of the competitions they took part in.

Die Realschule Webling im Südwesten von Graz ist eine Schule mit sechs Schulstufen für SchülerInnen ab dem 10. Lebensjahr. In den sechs Jahren werden die SchülerInnen auf eine spätere Berufslaufbahn als Facharbeiter bestmöglich vorbereitet. Die Schule kann mit der mittleren Reife abgeschlossen werden. Parallel zur Entwicklung dieses Schultyps, den es nur in der Steiermark gibt, wurde vor mehr als 10 Jahren die Informations- und Kommunikationstechnologie an der Schule eingeführt, um die SchülerInnen zukunftsorientiert auf später erforderliche Fähigkeiten und Fertigkeiten im Beruf vorzubereiten. Die RS Webling war die erste Schule in Österreich, die sich im Internet präsentierte. Zahlreiche Projekte unter Einbeziehung der IKT wurden schon durchgeführt und es wurden auch schon einige Wettbewerbe, an denen die Schule teilgenommen hat, gewonnen.

2.2 Case studies

OECD/CERI ICT PROGRAMME

A Case Study of ICT and School Improvement at

Secondary School, Grein, Austria



October 30th, 2000

The pilot study was carried out at the secondary school of Grein.

Overview of the present

Grein is a small town in Upper Austria situated on the Danubia River. It has about 3,400 inhabitants, and roughly half of the working population in Grein commute to jobs elsewhere. The secondary school of Grein, called HIT Grein (Hauptschule für InformationsTechnologie, e.g. secondary school for information technologies) has approximately 230 students aged 10-14 who are taught by 34 teachers in 10 classes. Secondary schools in Austria have four grades. HIT Grein has a modern sports field for athletics and a library with one desktop computer with internet access. In addition, there are two computer labs with 16 desktop computers per lab. The PC's are connected to the Web by modems, and all PC's are integrated into a LAN-network. At the moment there is only one ICT-class, so two labs are sufficient. However, the labs will be bursting at the seams with the beginning of the next school year, when the second ICT-class will start.

One year ago, the staff of this secondary school set up a special class for children who want to gain knowledge about ICT (e.g. hardware, software and programming). A further goal is to transmit abilities and skills for using ICT effectively. A small teacher team has created an extraordinary curriculum with a special schedule for each of the four years. The local school board approved this self-initiated school program and provided the additional funding needed for the staff.

There are several reasons for his school approach. On the one hand it should produce higher academic results, and on the other hand the school should establish a new academic profile which should help to save this location. Due to this specialization, student enrollment is expected to increase in the future. Creating a new academic profile is a noticeable trend in Austria in several types of schools. Students benefits from this school approach in different ways.

Overview of the past

The main problems of this site were the decreasing number of students and the decreasing level of student performance. It is alarming that many pupils are not able to write one sentence correctly by the end of the school (statement of a teacher). The teachers at this school share a common approach to solving these problems. ICT is the magic word. The use of ICT was introduced step by step.

First, a small group of teachers used the ICT for their teaching preparation, thereby gaining special knowledge about ICT. But the knowledge gained was not sufficient for teaching students in class, so an extensive program for staff development was created and implemented. Every teacher was required to attend either in-house or outside courses in ICT to gain the knowledge necessary to use and teach ICT. Half of the teaching staff resisted this policy until a team of teachers informed their colleagues about the advantages and the necessity of these changes. Today the majority of teachers accept this school approach.

Secondly the whole range of ICT (technical equipment) had to be financed and installed. Funds for hardware and software from several companies and the municipality allowed the school to set up two computer labs with modern equipment. Two teachers and an external IT-company implemented the entire ICT. They also administer and support the network.

Projections for the future

What would happen if all ICT were removed for the next school year? This question was answered by the majority of the teachers with one word: "inconceivable".

The school administration defined two goals for the near future. One goal is to establish an information tower containing three or four PC's with free internet access for the pupils in the school entrance, so the students can check their e-mails and use the Internet without being monitored. The second goal is defined: "One PC with Internet access in every class to avoid capacity problems in the labs." Every teacher should have the possibility to use the PC and the Internet directly in the classroom. Last but not least, it is very important to attract and to keep IT-specialists and ICT-trained teachers in order to maintain and improve the present situation. All these investments are dependent on the financial situation and the engagement of the school administration.

The expected increase in the number of students will force the staff to establish an entrance examination. This procedure will make it possible to select those students who have the best abilities and knowledge. A team which consisting of some staff members and a psychologist will develop this entrance examination.

What are the main indicators of success in such an ICT school approach?

- Readiness of the proper authorities to change legal conditions to allow the implementation of a self-initiated academic program with an intensive focus on ICT
- Provision of financial and human resources for the whole process
- Self-initiative and engagement of a competent teacher team
- A school program containing goals, instructions, extraordinary curriculum and schedules
- Provision of space for special educational needs
- Openness to change among the whole staff

Conclusion about key hypotheses

Hypothesis 1

Technology is a strong catalyst for educational reform, especially when the World Wide Web is involved. The rival hypothesis is that where true reform is found, technology serves only as an additional resource and not as a catalyst, and that the forces that drove the reform also drove the application of technology to specific educational problems.

The analysis of the data collected indicates that hypothesis 1 can be verified - with some restrictions. That means in the case of Grein, the implementation of ICT was not a planned social change but the start of a social change. If the teachers decided to create another main emphasis like sports or music, this would probably be the catalyst for the reform. Therefore in our case ICT is the magic word and a strong catalyst for school reform in the secondary school of Grein. There were of course additional resources besides the ICT which served the innovation, but the whole infrastructure of ICT is and will be the main indicator of this school approach. The teachers already know that one problem will occur at the beginning of the next school year: the capacity problems in the labs. Without sufficient and modern ICT-resources, the curriculum developed will not be transformed and the education goals for ICT will not be reached. A further factor which has forced the staff to react is the decreasing number of students. In order to atract more students, the staff decided to put the main emphasis on ICT. The last and very important factor is a competent and engaged teaching team. The majority of the teachers indicated that a team of four or five led and organized the whole innovation, provided and continues to provide support, and will develop further improvements. Without their engagement, an organizational change would not have been possible.

The use of ICT was identified as one solution for the specific need for change in Grein. As the solution for educational reform, ICT was the catalyst, that allowed the plan to be put into action immediately.

Hypothesis 2

The diffusion of the reform (and therefore of ICT) followed the traditional diffusion pattern for reforms and innovations as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and reforms and that different diffusion patterns therefore occur. The diffusion of the organizational change followed the traditional diffusion pattern. ICT was the content of the changing process, but at the start it was not the driving force of the change. In the first step, there was a small group of interested people who learned and used several ICT-skills, e.g. word processing, design web page, etc. With the technical expertise they acquired, these teachers were able to teach special ICT-subjects in the school.

The next step was on the one hand to create an extensive concept containing goals, instructions, extraordinary curriculum and timetables and on the other hand to convince the majority of the necessity and advantages of this school approach. Convincing the teaching staff was the most difficult part of the organizational change because in our case the average age of the teaching staff is very high. Some teachers will retire in the next five years and are therefore not willing to learn more about the new technologies.

A special diffusion pattern could be the so-called "education highway" in eastern Austria. The education highway is a web-based education network where schools and other educational institutions can post their own web-pages and search for information about schooling and education. In our case, the director and his team searched the education highway for sites about such school approaches done in the past. They found two secondary schools in Vienna and contacted them. An exchange of ideas took place between some of the teachers from Grein and Vienna; as a result they got an impression of an functioning ICT-curriculum. The information helped them to develop their own ICTbased curriculum for their specific needs.

Hypothesis 3

Successful implementation of ICT depends mostly upon the technological infrastructure and student ICT competence rather than upon staff competence in the integration of ICT into instruction. The rival hypothesis is that teachers mediate such applications when they are successful, and that their academic value relates positively to teacher competence. In fact the rival hypothesis shows this situation regarding the use of ICT. The more familiar and comfortable teachers are with using ICT, the more they will use it for their teaching preparation and for their actual teaching. Without the necessary technical knowledge of the teaching staff, the mediation of applications can not be successful.

The main fear of many teachers was that the students might have more technical expertise than themselves. A further change must take place -a change in their own views. In this case teamwork is the magic word. Students and teachers have to constitute a team, then the process of learning can take place based on partnership.

Hypothesis 4

Gaps in performance between high and low income students will be enlarged rather than diminished where all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to high poverty students closing the gap with low poverty students.

The principal, teachers and parents all concurred that learning with ICT has benefited all the students who have participated. In the case of equal access to ICT, the performance of the students depends on their personal interest and engagement. The condition of equal access to ICT is satisfied on the one hand during the lessons. But on the other hand, equal access is not guaranteed at home, where homework or several exercises have to be done. Engaged and interested students find ways to use computers outside the school, e.g. meeting classmates who have a computer at home, but the competition conditions are not the same.

In Austria, having a computer at home is not a question of income level; it is more a question of the attitude and the technical expertise of the parents. One statement of a teacher underlines this result: "Basically, today changes are taking place throughout the whole population, but the use of computers is different. I believe people are saving money elsewhere. There are computers at every level of society."

That's the view of the teachers in Grein, but other empirical studies in Austria disprove this statement. Having or not having a PC is a question of social stratification. Several studies in Austria show that low income families have significantly fewer PC's at home than families with higher incomes.

Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

In fact, academic standards are a function of teacher and school expectations. The teacher decides which teaching material will be used during the lesson. Some teachers said that while much of the teaching material on the web and the software market is good, there is also poor quality material. The task of the teacher is to choose the material that will be beneficial. If the teacher selects good ICT teaching materials, then ICT will not lead to a lowering of academic standards. On the other hand, if he or she does not pre-select special Web sites and allows the students to browse the Web without any restrictions, many students will be overtaxed because they will not be able to understand the information they find.

Characteristics of the school

The following is a detailed description of the school site, beginning with the central idea of the secondary school in Grein.

Name of school site	HIT Grein			
Address	A-4360 Grein, Groißgraben 2			
Phone / Fax	+43-7268/704614, +43-7268704615			
Founded	1920			
Administration	Principal: Mr. Dittmar Handel			
Number of classes	10 (8 HS + 2 PTS)			
Number of students	241			
Number of teachers	30			
Kind of school	HS = Hauptschule (secondary school for students be- tween the ages of 10 and 14) and PTS = polytechnical school (final compulsory 9^{th} year for students who will go on to an apprenticeship)			
Peculiarities of school autonomy:				
School experiment	HIT = secondary school for information technology (offers an examination in ECDL = European Computer Driving Licence during 4 years of school time)			
Unusual features	Applied word processing in the 8 th year (1 lesson a week) Applied spread sheet in the 8 th year (1 lesson a week) Typing in the 6 th year (1 lesson a week)			
Social-integrative classes (co-teaching of normal and handi- capped students)	In the 5 th , 6 th , 7 th years			
Expert divisions of Polytechnical school	 Technical fields (woodwork, construction, metal) Commercial field Human-creative field 			
Peculiarities of the school site:				
Library	PC with internet-connection			
2 computer labs, 16 PC's per lab; 4 extra PC's	WINNT-network + 16 WIN98 workstation; WIN2000TS-network + 16 WIN95 workstation; 20 Pentium and 16 486DX, 3 network-printer 1 digital camera, 1 scanner, 1 beamer			
Sport and playing fields	soccer, beach volleyball, athletics			
Web	http://hitgrein.eduhi.at			

Success as a result of good work

Some of the highlights and awards of the past years clearly show the work of the teachers and students in Grein.

• A qualitative study of the University of Vienna "Project work on Austrian and South Tyrolean School Sites" identified the secondary school in Grein as one of the ten model schools.

- The internet project "GRIPS = Greiner Internet Plattform für Schüler" (e.g. Greins internet platform for pupils) won the "Cyberschool" contest award for the best project carried out by a secondary school in Upper Austria in the school year 1997/98.
- The contribution of the "Digital Campfire HOLODECK" won first place in Austria and was exhibited at both the Guggenheim Museum in New York and the National Exhibition of Styria.
- Students of the secondary school in Grein developed and programmed a homepage for a local information system about Grein. This project won one of the main prizes in the "Cyberschool 1999" contest and went on to compete in the "PRIX ARS ELECTRONICA U19".

Evaluation of change

Diffusion patterns

The principal and a small team of teachers decided to introduce a school experiment. This group of experts defined goals and created an self-initiated academic program with its own curriculum. The school experiment was shown to the proper authorities and their teacher colleagues. The authorities finally gave permission to implement the concept, but only after a great deal of campaigning and discussion. This was one of the most difficult hurdles.

The ICT implementation at this site began with the step-by-step installation of the technical infrastructure. First of all, the IT specialists and an external PC company installed the hardware (lines, network, PC's, printer, scanner,...) and the necessary software (Win 95, Win 98, Win-Nt, Office and several special application programs).

Professional development activities had to be introduced after the installation of the technical infrastructure. ECDL (European Computer Driving License) is the buzzword

in professional development in Grein. Every teacher has to participate in ICT trainings to gain the necessary knowledge and abilities to train students in ICT subjects. The training cycles end with an examination. Teachers who pass the exam receive a certification which is recognized in Europe. Many teachers make use of the ECDL.

In the next step, a special curriculum was created and installed. Computers were increasingly integrated into lessons. Students had to learn to type very early because that is the prerequisite for meaningful computer use. The subject "Typing" was therefore integrated in the 6th grade. Additionally two "new" subjects were implemented in the 8th grade: Applied Word Processing and Applied Spreadsheet Analysis. In Applied Word Processing, teachers and students often use the Internet to search for specific topics. The principal and his team tried to introduce ICT-subjects which the public (e.g. pupils, parents, other schools, businesses, ...) accepted and needed. This was obviously a wise choice: 100 % of the students enrolled in an elective course, e.g. computer science, which shows their great interest and high level of motivation.

Money is always an issue. The technical equipment is expensive, and the life of the hardware is very short. Money is urgently and constantly needed. The principal tries to co-operate with local companies in order to both get additional financial resources and provide students with the opportunity to work on a "real" project and get to know potential employer. A further source of income is sponsoring: last year, for example, a company provided the funds for a digital camera.

Staff development and involvement

Continuing education and training for teachers in Austria is organized by a special institution called PI = Pädagogisches Institut (i.e. Pedagogical Institute). At present, the problem of the PI is that its training program contains a wide range of subjects, from cooking to ICT. The number of special ICT trainings has increased each year, but it still does not satisfy the demand. As a result, there are long waiting periods results for courses - an unsatisfactory situation. The content of these trainings are matched to the needs of teachers for their educational work. The staff development currently taking place is not obligatory, free of charge, and without any recognition.

The IT specialist at Grein is also a member of the PI training staff and has done several PI trainings in the school, which many teachers attended. The great demand for ICT trainings has created an extraordinary situation in Grein: ICT teachers from the school have trained and coached their colleagues voluntarily in their free time without pay. Members of the small work groups meet regularly to learn from one another and exchange experiences. In addition to the knowledge gained in ICT, other results of this self-initiated training program have been very positive: an increased interchange of ideas, teamwork, broadened horizons, and more information. This kind of staff development is a remarkable example of engagement and self-initiative in Austria. Nevertheless, trained IT specialists are urgently needed in this school.

Role of leadership

The principal and his team were responsible for implementing this school experiment and oversaw the entire ICT installation and staff development. These key persons also set the tone and determine the direction for the future.

ICT reform connections

"ICT is the wave of the future," answered one teacher during the evaluation. Responsible computing and teamwork is the basis for many of the new jobs in the IT-branch. Students should have the opportunity to get these basic qualifications in the school. ICT also functions as a catalyst for the reform to keep students from the area in Grein who might otherwise leave to attend other schools elsewhere. Lower ability students, who have no chance of being accepted by another school, are forced to stay in Grein, while those with higher abilities can choose the type of school they want to attend.

Their learning would bring about a decrease in performance level. Now, however, the ICT school experiment has changed this situation, and increasing enrollment has made it necessary to introduce an entrance test.

Outcomes

ICT Infrastructure

The secondary school of Grein aims to provide an environment where teachers and students use ICT in their teaching and learning processes. The following ICT infrastructure is situated in the school:

a) Hardware

2 computer labs with 16 PC's per lab. All PC's are Web integrated and multimedia ready. The library, the conference room, and the main office each have a PC. Additionally a scanner, a beamer and a digital camera are available.

b) Internet

Internet access is managed by an ISDN-modem, and an Internet connection via satellite is being tested.

c) <u>Support</u>

Two teachers called "Kustoden" provide support, but the Grein staff is also helping itself. Information about hardware features and software is provided by the external company which is responsible for the delivery and installation of new ICT equipment. If possible, teachers repair defective hardware themselves. Otherwise, the above-mentioned company arranges for repairs, which will be paid for by the community. Both custodian teachers invest a lot of time to keep the system running. They see an urgent need to enlarge the IT-team by a third qualified person because both of them are completely overtaxed.

d) <u>E-mail</u>

At the moment, students do not have school e-mail accounts. They will get their own accounts when the information tower in the entrance hall is installed some time in the future. One official school e-mail account was set up for the main office, and some teachers have private e-mail accounts.

e) System backup

The backup of the system and the configuration is made by a streamer tape, but this is only done occasionally, but not regularly. Data created by teachers and students is not automatically saved. It is the responsibility of teachers and students to save the data they produce themselves.

f) Use of ICT

ICT is used in projects, spreadsheet analysis, word processing, preparing and carrying out presentations, programming, creating and maintaining Web pages, and drawing pictures or diagrams. Teachers sometimes integrate CD-ROM's which contain special learning software in their teaching.

g) <u>Computer magazines</u>

The school does not subscribe to any dedicated computer magazines. Some teachers donate old issues of their private magazines to the library.

h) Multimedia library

The multimedia library is equipped with a PC which has internet access and can use special software e.g. encyclopedia, Physics, Geography, The Human Body, English, Mathematics, German.

i) Unusual feature

Slow PC's are connected to a powerful server, so together they function like a client-server system. The slow PC's only task is to function as an external monitor. All application programs are installed on the server.

j) Provider

The education highway powered by the authorities is the main provider for schools in Upper Austria. Laws prohibit the use of private providers by schools.

Effectiveness

On the one hand, the decreasing numbers of students has led to a new positioning of the school philosophy; on the other hand, the economy's increasing demand for ICT skills

has led to a change in the subjects taught. The following points highlight some indicators of the success of ICT school innovation.

- Well-educated, engaged and interested staff members are absolutely necessary to integrate ICT successfully in the school. Without the engagement of ICT experts, the process of change is not possible. Professional development in using ICT has to be organized systematically. Possibilities for further education must be guaranteed.
- Generating interest and motivation: Teachers' attitude and their conviction that they are on the right path is essential.
- Setting goals is important. A mechanism for checking the attainment of the goals defined has to be implemented.
- Providing the necessary hard- and software for using ICT in school is absolutely necessary. Teachers will not be able to integrate ICT in their teaching if the hard- and software equipment is not available, supported and user-friendly.

What are the barriers to fuller staff involvement?

- negative attitude of some teachers to ICT
- current situation of further education (waiting period of six months to one year). A lack of ICT-knowledge is the negative result.
- lack of capacity in the labs
- a lack of professional self-assurance

The role of the teacher changes when he or she uses ICT. The teaching style becomes more dynamic. During a traditional lesson, the teacher functions as an instructor. All aspects of the teaching and learning interaction are under the control of the instructor. However, the role of a teacher in ICT assisted lessons changes from that of an instructor to that of a coach. The coach transfers some control over the learning process to the learners, thereby increasing the individual autonomy of the students. On the one hand, this teaching style responds to contemporary realities and the changing environment. One the other hand coaching and using ICT during the lessons is very strenuous for teachers because students' individual problems require individual attention. An additional result of coaching is a change in the way both students and teachers work with knowledge. "The teacher knows everything and the students know nothing" is an old adage that loses its validity. Students find a lot of information in the Internet and have to select the most important facts, but they are often unable to structure and understand the knowledge gained. The new task and the challenge of teaching is to structure the information and discuss it with the pupils.

What are the most positive and the most negative aspects and impacts of using ICT in Grein?

Positive aspects

- + ICT gives students the opportunity to develop valuable skills (team work, selforganization, being and working independently)
- + ICT is a strong motor for the motivation of students. As one English teacher put it: "First of all I train new vocabulary verbally in cooperation with the students in the classroom. Afterwards we go to the lab, and the students can use a multimedia CD-ROM to learn and deepen the new vocabulary in written form. When say we are going to the lab, the whole class shrieks with delight."
- + Start-up grant for entrance into a high school or a profession
- + ICT supports students who are interested in this field. They often have computers at home and are actively involved in ICT. Almost 60 % of all students at Grein use a computer at home.

Negative aspects

- Students spend a lot of time using ICT. Kids often spend their free time in front of the computer. One critic told us, "I find their social development very questionable. Computers are taking over control of our children and our profession. There is no time left to be a child."
- The implementation of ICT in schooling has divided the teaching staff into two groups: to those who are fascinated by and engaged in using ICT, and those who

were opposed to the new technology. This split has led to questionable deterioration of the working atmosphere. The digital divide within a profession?

- ICT reduces the whole personality of students to one factor: who is computer literate and who isn't. The personal interests and other abilities of the students are often not taken into account. The digital divide within the pupils?
- Face to face situations during the lessons are becoming increasingly rare. Interpersonal relations and communication are suffering.

Academic rigor

Academic rigor depends on the following items:

- Readiness and time for further education: It's necessary for every teacher to have his own PC at home to work individually. The PC should be used for preparing lessons, administrating, and communicating with several groups of people. The prerequisite for teachers to use ICT in classroom instruction is that they feel very comfortable working with ICT.
- ICT specifics have to be taken into consideration by creating an academic schedule.

How can the situation concerning academic rigor in Grein be characterized? The teachers often prepare tests and teaching materials (e.g. worksheets, presentations) on the PC. Some teachers use special learning software (CD-ROM's) for their teaching. Sometimes teachers and students work together on a project using ICT. The more teachers use ICT during their lessons, the more students profit from it. Sometimes the Internet functions as a complement to school books because it offers the latest information. The internet, however, can not replace a good school book because it's very unstructured, and students often find too much information in the web which they do not understand. ICT access is guaranteed during the lessons or after school hours if a teacher gives the students special tasks. Teamwork only occurs during project work, not during the use of learning software. The students are monitored while searching for information in the Web in an effort to curb abuse (chatting, sending SMS's, viewing unsuitable content,...).

Paid contracts from local companies are very popular because they give the students practice and greatly increase their motivation.

Equity

Grein had the following experience with equity:

- The Web motivates students to search for new information about several topics, so students ate also more likely to find information about foreign cultures. The Web provides a new form of access for multicultural learning.
- Teamwork occurs among teachers and students who are interested in ICT. Three teachers and three school classes, for example, worked together on the project "Riddles for the Web and the local newspaper".
- During school hours, all students have equal access to ICT, so there are no differences between high and low ability students. On the other hand, low-income students have equal access at school but not during their free time.

Projections

Sustainability

What has to be done in Grein to preserve or improve the results of using ICT? The recommendations can be divided into five categories.

1. Technical equipment

- Regular replacement of the old technical equipment.
- Expansion of the existing equipment: one or two computers with Internet access in each classroom, multimedia-tower in the entrance hall, installation of a third computer lab.
- A media center which contains several kinds of CD ROM's for special subjects.

• Quick and reliable external support for hardware problems.

2. Organization

- Enlarging the school district to include the area where students live. At the same time, the school should try to avoid losing high ability students to other types of schools.
- Having one full-time IT specialist who manages the whole ICT system would be very helpful.
- Organizing access to the computer labs better in order to give every teacher the opportunity to use ICT. Without an expansion of one or two PC's per class, this is not possible.
- Rethinking the organization of the lessons in the future is vital because of the enormous capacity problems to be solved when there are four HIT classes.

3. Staff

- Well-educated staff members are essential. Many of Grein's teachers have passed the ECDL. Further education has to be guaranteed for everyone.
- It is absolutely necessary to hire new, well-educated ICT teachers. The integration of the new staff members should be systematic, organized, and geared to establishing a strong teaching team.
- The working atmosphere in Grein should be improved because the motivation of some teachers was destroyed by the introduction of ICT.
- The IT specialists who manage the support for staff and students should be better paid because they invest so much time in keeping the system working.
- The new technologies are one possible way to save teachers' jobs.

4. Environment

- Growing number of homes with computer equipment.
- More parental interest in ICT to support the students at home. Collaborative learning between students and parents can occur.

• If the parents have knowledge about ICT, they should take the necessary precautions against forbidden internet use, e.g. talk about abuses of the Web, encourage students to practice responsible computing,...

5. Education

- Constant evaluation of the current needs in ICT skills for high schools in order to ensure that graduates of a secondary school have the skills they need.
- Teachers should encourage their students to practice responsible computing, thus avoiding abuse. One ICT course should be "The Social Dimension of the Web".
- It is vital to teach basic ICT skills in addition to reading, writing and arithmetic. New special ICT subjects were created, e.g. "measure, control and regulate".

Scalability

What efforts and resources are required for full implementation and what benefits can result from it? This question must be answered indirectly, because the interviews didn't contain the necessary data. The main points are described below.

- The principal and the staff members must define a common goal which they will directly pursue.
- The authorities and the communities of the schools have to support the efforts of the staff members not only by providing financial resources but also by creating the basic conditions necessary to act.
- Further trainings for staff members must be organized and supported in order to give teachers input on innovations and the opportunity to discuss pedagogical topics.
- All subject teachers should use ICT to the same degree their lessons; otherwise, the students of teachers who don't use ICT in the lessons will be a disadvantage compared to the students of teachers who use ICT. The individual philosophy of

a teacher determines whether he/she is suited to implementing ICT into his/her teaching.

Methodical reflection

Based on feedback from our pre-pilot studies, we propose the following changes. The term "reform" was often expressed differently by the interviewees, for example, as the expansion of the curriculum-offer or changes. The term "reform" should be further clarified.

1. Teacher Interview

Sometimes the teachers were not able to answer any questions because they didn't understand the meaning of the questions or they didn't have the necessary background knowledge. The following questions proved difficult to answer.

- Perspective on reform: Are high and low ability students impacted equally?
- Value: What role does it play in the academic program?
- Value: How does it relate to the reform? (Very abstract we would remove this question.)
- Maintenance: What support is in place to keep it working? (A lot of teachers didn't have the background knowledge to answer this question.)
- History: Who embraced it first/last? (This question should be further clarified for example classification in groups by ages, gender, subjects,...)

2. Parent/Guardian Interview

Parents who also use ICT were better able to answer the questions. The language of the questions was unfamiliar to some parents. Clear differences were recognizable in the level of educational. The parents were to some degree overtaxed by some questions, for example:

- Child's interests: What is the most interesting or exciting thing your child has done at this school?
- Perspectives on ICT: How much use does your child make of ICT at school?
- Perspectives on ICT: Are any students being left out because of ICT use in the school?

3. Administrator Interview

In the secondary schools in Austria, there is no school administrator. The principal of the secondary school performs the tasks of an administrator. Therefore, we conducted part of the administrator interview with the principal.

Translation

Sometimes different meanings resulted from the translation of the questions. For this reason, we have changed some pre-determined questions on Austrian realities, e.g.

-> Nomination Form for a School Site

• Transiency rate of students (the ratio of the number of non-full term students to full term students)

-> Parent/Guardian Interview

• What are your child's extra curricular interests?

-> Student Interview

- What extra curricular activities do you do?
- What extra curricular activities do your closest friends do?

Experience and support

• Planning and organizing for a site visit

After site selection, the research team announced the extent of the research to the principal by e-mail (total number of interviews per category). That was very helpful, because the principal could arrange certain appointments with parents and teachers in advance.

• Site visit

At the beginning, the principal introduced the research team to the staff. Afterwards, we took a tour of the school and scheduled interviews and observations. A critical point was the selection of the people to be interviewed. On the one hand, it was easy to find teachers who were closed involved in and strongly identified with the reform. On the other hand it was difficult to identify teachers who were opposed to the reform. The research team was very impressed by a teacher who was opposed to the reform and he volunteered as an interviewee. Quotation: "I would like to talk about the other side of the coin, to discuss those points that none of the teachers speaks about openly, such as frustration, overstrain, social isolation, fear, and discrimination,..." This interview was conducted as an open conversation, and the content was very exciting. The support of the teachers, like that of the principal, was fantastic. Everyone was very helpful, co-operative and friendly.
Appendix A

Methodology

Description of the volume and type of data collected

Activity	Annotation	Amount
Verbal Interviews (approximately		
45-60 minutes each)		
Nomination Form for a School Site	Principal	1
Administrator Interview	Principal	1
Parent/Guardian Interview	2 mothers, 2 fathers	4
Technology Specialist Interview		2
Student Interview	1 group of 6 students (first year)	2
Student Interview	1 group of 5 students (fourth year)	2
Teacher Interview	4 teachers who were actively involved in and	
	strongly identified with the reform.	8
	4 teachers who were opposed to the reform.	

Questionnaire		
ICT Use Survey of Teachers	Teacher	23

(Observing in Classrooms		
	Computer science	fourth year	2 hours
	English	second year (use an instructional program)	1 hour
	Gymnastics athletics competition	all classes	2 hours
	Technical Project	fourth year (Poly)	3 hours
	Word processing - Internet	fourth year	1 hour

Collecting additional materials		
Web-site presentation	http://hitgrein.eduhi.at/	
Web-site presentation of a school	http://www.grein-	
project	donau.at/greinol/hauptgr.htm	
Student-generated materials	riddle (die Knofelecke)	
Lesson plan from the IT class		
Reports on the experimental school		
form		
Plans for school improvement		
School report	from a fourth year	

Appendix B

ICT Use Survey for Teachers

15 teachers filled out this questionnaire (n = 23). The results are represented in percentage (100 %).

• How comfortable are you with using a computer to do each of the following? (Choices are:, very comfortable, comfortable, somewhat comfortable, not at all comfortable)

		very com- fortable	com- fortable	somewhat com-	not at all com-
1	г. •.	70.0	01.7	Tortable	Tortable
1.	write a paper	78.3	21.7	-	-
2.	search for information on the WWW	27.3	31.8	27.3	13.6
3.	create and maintain web pages	4.4	4.4	17.4	73.9
4.	develop and use a data base	17.4	8.7	30.4	43.5
5.	send or receive e-mail	18.2	27.3	45.5	9.1
6.	programming (e.g. writing a program in Visual BASIC or Java)	8.7	-	91.3	-
7.	draw a picture or diagram	26.1	21.7	21.7	30.4

• How often do your students on average do the following for the work you assign? (Choices are: almost every day, a few times each week, between once a week and once a month, less than once a month, never)

		almost every day	a few times each week	between once a week and once a month	less than once a month	never
8.	use a computer for any purpose	27.3	27.3	36.4	9.1	-
9.	use the World Wide Web	26.1	34.8	21.7	17.4	-
10.	create web pages	-	-	4.6	-	95.5
11.	send or receive e-mail	4.4	8.7	17.4	21.7	47.8
12.	use a word processing program	26.1	39.1	21.7	8.7	4.4
13.	use a computer to play games	-	4.4	13.0	26.1	56.5
14.	use a spreadsheet	4.4	21.7	13.0	-	60.9
15.	use a graphics program	-	4.6	27.3	27.3	40.9
16.	join in an on-line forum or chat room	-	-	-	4.4	95.7
17.	use a graphing calculator	4.4	4.4	8.7	8.7	73.9
18.	use a digital camera	4.6	4.6	9.1	18.2	63.6
19.	use an instructional program (including simulations)	4.4	8.7	52.1	17.4	17.4

20. How would you rate your ability to use a computer? (Choices are: excellent, good, fair, poor)

9.1	excellent
18.2	good
45.5	fair
27.8	poor

21. Is student computer use ever evaluated for grading? (yes-no)

35.0	yes
65.0	no

22. If you assign World Wide Web searching, how much freedom do you allow students in locating sites to visit? (no restrictions, some restrictions, designated sites only)

16.7	no restrictions
44.4	some restrictions
38.9	designated sites only

23. Do any of the classes you teach have a web page? (yes-no)

15.8	yes
84.2	no

24. What portion of the computer use in your classes is directly related to the course content (as opposed to rewards or incentives, for example)? (all, most, some, very little)

27.3	all
9.1	most
36.4	some
27.3	very little

25. What portion of the computer use that you assign is done by students individually? (all, most, some, very little)

4.8	all
47.6	most
33.3	some
14.3	very little

26. How often do you use a computer at home for preparing for teaching? (almost every day, several times a week, etc.)

27.3	almost every day
50.0	several times a week
22.7	etc.

27. Have you ever participated as a student or instructor in a virtual course through the Internet/World Wide Web? (yes-no)

27.3	yes
72.7	no

28. Have you ever involved your students in collaborative learning over the Internet/World Wide Web with students from other classes? (yes-no)

4.4	yes
95.6	no

29. Do you participate in any on-line professional chat rooms, forums, or the like? (yes-no)

4.4	yes
95.6	no

30. How many e-mail messages do you send and receive each day? (more than 12, 6-11, 1-5, none).

-	more than 12	
4.4	6-11	
34.8	1-5	
60.9	none	

• Have you ever done any of the following? (Choices are: yes, no)

		yes	no
31.	made changes to a computer's memory chips, hard disk, or processor	17.4	82.6
32.	installed an update to an application program (word processor, graphics program, etc.)		56.5
33.	installed a computer on a network	17.4	82.6
34.	created or managed a web site	8.7	91.3
35.	developed a data base with more than 25 records	30.4	69.6
36.	used a digital camera	39.1	60.9

OECD/CERI ICT PROGRAMME

A Case Study of ICT and School Improvement at Secondary School, Vienna Kinkplatz, Austria



January 29th, 2001

Overview of the present

Vienna, the capital city of Austria, is situated in the eastern part of the country. It has about 1.6 million inhabitants and is divided into 23 districts. The secondary school of Kinkplatz is located in the 14th district. The social stratification of the 14th district cannot be characterized precisely: its inhabitants range from shift-workers to bank employees. The secondary school for information technologies Kinkplatz has approximately 230 students aged 10 - 14 who are taught by 26 teachers in 12 classes. One class will be conducted as an "integrated class", meaning that handicapped and normal students learn together. At present, 229 students with ten different mother tongues attend this school, and 55 % of the students do not speak German as their mother tongue. The school has a sports hall, a library, a photography darkroom, a chemical laboratory, workshops and three computer labs.

In 1992/93, the staff of this secondary school set up a special pedagogical model, called "Kleinklassenmodel" or small class model. The lessons are held in small groups. The results of this pedagogical model are self-explanatory (the number of students per class was decreased, and students are monitored by a small teacher team) and the advantages include better social contact and more effective learning. This pedagogical approach would not be such a success without the extraordinary engagement of a small team of teachers.

The second pedagogical concept at this school is based on ICT. There are three computer-labs with eight desktop computers per lab. The PC's are connected to the Web, and all PC's are integrated into an ISDN-LAN-network. In Vienna, several secondary schools worked together to create an extraordinary curriculum for ICT with a special schedule for each of the four years. They also defined the basic conditions which every ICT-school has to pay fulfill. The local school board approved this self-initiated school program and provided the additional funding needed for the staff. This school approach pursues specific goals. Teachers should deepen students' understanding of ICT within a specific ICT subject. Typing on the PC is taught in addition real EDP-subjects in the first class, making working with the keyboard easier for the students. The Internet should open up the possibility to intensify communication with other schools. Computers and the Internet are also integrated into many subjects, creating one problem: The labs are bursting at the seams.

Overview of the past

In general, the main problems of the secondary schools in Vienna were the numbers of students who left the high school and the decreasing level of student performance. A further point was the competition between the secondary schools themselves. Kinkplatz's teachers share two common approaches to solve these problems. Small classes and ICT are the buzzwords, and the reasons are the same for both school approaches. On the one hand, he two factors should produce higher academic results; and on the other hand, the school should establish a new academic profile which should help guarantee its future (as it has in other ICT schools). Creating a new academic profile is a noticeable trend in Austria in several types of schools.

Both school approaches, small classes and the use of ICT, were installed step by step. We give priority in this report to the pedagogical concept based on ICT. One teacher took the part of a forerunner, dealing early on computers (hardware and software). Little by little, he tried to fill more and more teachers with enthusiasm for the new technologies. Every teacher was expected to attend either in-house or outside courses in ICT to gain the knowledge necessary to use and teach ICT. Many teachers were interested in ICT, so they attended courses and passed the examination for ICT. One great problem occurred during this stage. There was an obvious willingness to pursue further education, but despite the yearly increase in the number of special ICT trainings, the demand could not be satisfied.

Vienna has one specialty program called "IHS", a concept for ICT schools worked out by teachers and policy makers together. At present, approximately 14 secondary schools are participating in this ICT school concept. IHS should facilitate the efforts of a "normal' secondary school to establish a new main emphasis in ICT. This concept has a lot of advantages but also disadvantages which will be explained in the following chapters.

Projections for the future

What remains to be done to complete the whole process? The principal noted, "First of all, every class should be equipped at least with one PC which is multi media ready and connected to the Web." Every teacher should have the possibility to use the PC and the Internet directly in the classroom during his/her teaching. These additional investments will help alleviate lack of capacity in the labs.

A further goal is to hire and keep IT specialists and ICT-trained teachers in order to maintain and improve the present situation. It is difficult to reach this goal because the level of ICT training in general teacher training is very low. At present, there are not enough high-level IT courses for IT administrators. The present situation calls for a radical change in general teacher training in Austria. A further characteristic of the Austrian education system is that the school administration of each federal province allocates the teachers to the schools. The principal has no chance to select the teachers his/her school needs.

An ambitious goal is to establish a network which will connect all the ICT secondary schools in Austria. The aim of this network is to ensure that all ICT schools achieve the same status, as is the case with music or sport secondary schools. At present, ICT-based schools in Austria are at a disadvantage compared to schools based on another main emphasis.

The main indicators of success in such an ICT school approach are the same as in other IT schools.

 Readiness of the proper authorities to change legal conditions to allow the implementation of a self-initiated academic program with an intensive focus on ICT

- Provision of financial support for ICT (hardware and software) and human resources for the whole process
- Self-initiative and engagement of a competent teacher team
- A school program containing goals, instructions, extraordinary curricula and schedules
- Funding for additional rooms (labs, classroom, ...)
- Openness to change among the whole staff

Conclusion about key hypotheses

The following hypotheses draw significant parallels between the secondary school of Kinkplatz and other IT schools.

Hypothesis 1

Technology is a strong catalyst for educational reform, especially when the World Wide Web is involved. The rival hypothesis is that where true reform is found, technology serves only as an additional resource and not as a catalyst, and that the forces that drove the reform also drove the application of technology to specific educational problems.

The analysis of the data collected indicates that hypothesis 1 can be verified – with some restrictions. That means, in the case of Kinkplatz, that the implementation of ICT was not a planned social change but the start of a social change, as it was in other IT schools. If the teachers decided to create another main emphasis like sports or music, this would probably be the catalyst for the reform. Therefore in our case ICT is one catalyst for school reform in the secondary school of Kinkplatz, and small classes are another.

One condition is, as the majority of teachers interviewed put it, that a competent and engaged team of teachers lead the whole process. Without their engagement, an organizational change would not have been possible. Working hardware and software is a further condition for school improvement. In the case of Kinkplatz, technical problems, especially with the Internet and hardware, occur frequently. The Internet connection often doesn't work and nobody knows why. The technicians say that the matter could be a combination of the lines and the school's location on a hill, but they don't know the exact reasons for the malfunction. As most of the teachers put it, "It is very difficult to prepare special Internet lessons because the chances that the Internet will work are slim." This important point will be dealt with in detail in the following chapters.

The use of ICT was identified as one solution for the specific need for change in Kinkplatz (just the same as in other IT schools). As the solution for educational reform, ICT was the catalyst that allowed the plan to be put into action immediately.

Hypothesis 2

The diffusion of the reform (and therefore of ICT) followed the traditional diffusion pattern for reforms and innovation, as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and reforms and that different diffusion patterns therefore occur.

The diffusion of the organizational change followed the traditional diffusion pattern. ICT was the content of the changing process, but at the start it was not the driving force behind the change (the same as in other IT schools). In the first step, some people from several Vienna secondary schools who were interested in ICT and the responsible policy-makers discussed the present situation. Together, the two groups reached an agreement. The focus for the next years is to create a concept (called IHS) concerning the implementation of ICT in secondary schools in Vienna. A project group was established. This project group worked out an extraordinary curriculum for ICT-schools, organized the purchase of hardware and software, provides support, and functions as an information office.

Once the ICT concept was developed, the next task was to motivate other teachers and arouse their interest. Some teachers were interested and attended several ICT trainings. With the knowledge they gained, the teachers are now able to teach ICT subjects and integrate ICT into several subjects.

A special diffusion pattern could be the so-called "education highway" in eastern Austria (just like Grein). The education highway is a Web-based education network where schools and other educational institutions can post their own web sites and search for information about schooling and education.

Hypothesis 3

Successful implementation of ICT depends mostly upon the technological infrastructure and student ICT competence rather than upon staff competence in the integration of ICT into instruction. The rival hypothesis is that teachers mediate such applications when they are successful, and that their academic value relates positively to teacher competence.

In fact, the rival hypothesis shows this situation regarding the use of ICT. The more familiar and comfortable teachers are with using ICT, the more they will use it for their teaching preparation and for their actual teaching. If the teaching staff lacks the necessary technical knowledge, the mediation of applications cannot be successful (just the same as in other IT schools). Professional development plays a very important role. Several teachers said they were willing to take part in ICT professional development and applied at the PI and other ICT trainings, but they were repeatedly turned away because the courses were full.

The greatest fear of many teachers was that the students' technical expertise might exceed their own. A further change must take place – a change in their own views. In this case, teamwork is the magic word. Students and teachers have to constitute a team; then the process of learning can take place based on partnership.

Hypothesis 4

Gaps in performance between high and low income students will be enlarged rather than diminished where all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to high poverty students closing the gap with low poverty students.

In the case of equal access to ICT, students' performance depends on their personal interest and engagement (just the same as in other IT schools). The condition of equal access to ICT is satisfied during the lessons, but equal access is not guaranteed at home, where homework or exercises have to be done. Engaged and interested students find ways to use computers outside the school, e.g. meeting classmates who have a computer at home, but the competition conditions are not the same.

Several studies in Austria show that low income families are far less likely to have a PC at home than more affluent families. Having or not having a PC is a question of social stratification and the profession of the parents. Parents who use a PC at work have better ICT skills and promote meaningful PC use at home. Pupils of parents who have no knowledge of ICT often only use the PC to play computer games.

Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content. In fact, academic standards are a combination of teacher and school expectations. The teacher decides which teaching material will be used during the lesson, and his/her task is to choose the material that will be beneficial. If the teacher selects good ICT teaching materials, then ICT will not lead to a lowering of academic standards. On the other hand, if he or she does not pre-select special Web sites and allows the students to browse the Web without any restrictions, many students will be overtaxed, because they will not be able to understand all the information they find. A German language teacher mentioned another point: "I think it is positive that wrong words will be underlined because the students have to think about their spelling mistakes." Another teacher said, "The appearance and layout of students' papers are now better than in the past, but the content has not improved."

Name of school site	Informatikhauptschule Kinkplatz
Address	A-1140 Wien, Kinkplatz 21
Phone / Fax	+43-1/911 63 43, +43-1/911 63 43 37
Web site	http://www.schulen.wien.at/schulen/914042/index.html
E-mail address	hs14kink021k2@m56ssr.wien.at
Administration	Principal: Mr. Wilhelm Scheiber
Number of classes	8 normal classes, which will be conducted as 12 stabile small
Number of students	229
Number of teachers	26 (17 male, 9 female)
Kind of school	Secondary school for students between the ages of 10 and 14
Characteristics of school au	itonomy:
School experiment	<u>IHS:</u> Secondary school for information technology (offers to pass some modules of the examination in ECDL = European Computer Driving License) Small class model: 8 normal classes are divided into 12 stabile
	small classes. A small team of teachers leads a small class.
	IT in the 1^{st} and 2^{nd} year (1 lesson a week)
Unusual features	Typing in the 1^{st} and 2^{nd} year (1 lesson a week)
	IT in the 3^{rd} and $4th^{d}$ year (2 lessons a week)
Social-integrative classes	One class will be conducted as an integrated class (co-teaching of normal and handicapped students).

Characteristics of the school

Special features of the school:		
Special rooms	Library, chemistry laboratory, darkroom, 3 sports hall	
3 computer labs	8 PC's per lab, 3 Server, WINNT + WIN95 3 network-printer, 1 digital camera, 2 scanner	
Internet connection	ISDN-LAN network	
Architecture	Impressive glass building	
Neighboring school	In the same building, there is another secondary school which provides lunch and full time support for their students.	

Evaluation of change

Diffusion patterns

One specialty in Vienna is the concept of "IHS". The idea of this project is on the one hand to facilitate the access to ICT for the students and on the other hand to train the pupils to become experienced and competent users of the new technologies. All learning technologies should be available during the lesson. Therefore the curriculum and the technical development have to be adapted to the new requirements. The concept "IHS" plays a major role for diffusing ICT in schools of Vienna. With the exception of the Vienna "IHS" concept, the diffusion patterns are the same as in other IT schools. A small team of teachers initiated, organized and oversee the introduction of ICT. The authorities support and finance the whole concept, including the provision and support of the technical infrastructure, funding to maintain and replace the technical infrastructure, ture, and last but not least the professional development.

Staff development and involvement

At present, the main problem in Vienna is that there are not enough ICT trainings to meet the demand (just the same as in other federal provinces). The teachers are willing to sign up for ICT development, but most of the courses are full, so the waiting lists are long and teachers are frustrated. This unsatisfactory situation has resulted in school-internal ICT development. One IT specialist pointed out another fact: "The PI offers

more elementary than advanced trainings. I urgently need some advanced trainings in several kinds of software, but these trainings will not be offered. Where am I supposed to get advanced IT skills to support our network?" In Kinkplatz, the situation is unique. One of the three PC-labs is owned by the PI, so many IT trainings are held in the school and computer experts are often present. The IT specialists of Kinkplatz have the opportunity to consult the experts when they need help. On the down side, the labs are often reserved for external teachers.

Role of leadership

One engaged and ICT interested teacher took preliminary steps. The principal and his team were responsible for implementing this school experiment and oversaw the entire ICT installation and staff development. These key persons also determined the next steps for the future.

ICT reform connections

The majority of teachers see the ICT main emphasis as current, trend-setting and necessary because it gives students the opportunity to acquire the basic ICT skills and they will need in the business world and advanced schools. But one teacher expressed his concern: "Public discussions of modern schooling, then education and instruction focus solely on the new technologies."

Outcomes

ICT Infrastructure

The secondary school of Kinkplatz has the following ICT infrastructure:

a) <u>Hardware</u>

Three computer labs with 8 PC's per lab. One lab is owned by the PI but the school has permission to use it. All PC's are multimedia ready and connected to the Internet. One computer is situated in the main office. Three network-printers, two scanners and one digital camera are also available.

b) Internet and Provider

Internet access is managed by an ISDN-LAN network. The education highway powered by the authorities is the main provider for schools in eastern Austria. Wienstrom is the special provider for the Vienna schools.

c) <u>Support</u>

In Kinkplatz, two teachers called "Kustoden" (custodians), the IT specialists of the school, provide support for the staff but are not authorized to change or repair any hardware by themselves. They don't have the password from the server that would allow them to change anything. The hardware support of this school is managed by the "Call Center", which functions like a helpdesk with several contact persons: on the one hand, the so-called "Regionalbetreuer", and on the other hand, several technicians from external companies. A "Regionalbetreuer" is a teacher who is specially trained in ICT, and every "Regionalbetreuer" supports four to five school networks in Vienna. If hardware or line problems occurs, the IT specialists of the school will inform the Call Center. The Call Center then sends a "Regionalbetreuer" to solve the problems. If the "Regionalbetreuer" is not able to repair the hardware or to solve the network problems, the Call Center will engage an external technician. The fact is that it takes both of the custodians a lot of time to keep the system running, and they are completely overtaxed.

d) <u>E-mail</u>

One official school e-mail account was set up for the main office. At the moment, students do not have school e-mail accounts. Some teachers and students have private e-mail accounts.

e) System backup

The backup of the system and the configuration is made by a streamer tape, but this is only done occasionally, but not regularly. Data created by teachers and students is not automatically saved. It is the responsibility of teachers and students to save the data they produce themselves.

f) Use of ICT

Teachers and students use ICT for typing; in projects, spreadsheet analysis and word processing; to prepare and make presentations; for programming (logo); to create and maintain Web pages; to draw pictures or diagrams; and to search for information. Learning software is used in special subjects, e.g. English or history.

Effectiveness

The results of Kinkplatz show the same indicators of success as in the other IT schools.

- Well-educated, engaged and interested staff members are absolutely necessary to integrate ICT successfully into the school.
- Teachers' attitude and their conviction that they are on the right path is essential.
- Setting goals is important.
- Providing the necessary hardware and software for using ICT: Many teachers in Kinkplatz mentioned that they had prepared special Internet lessons, but the network did not work. They said that they would not integrate ICT into their teaching unless the hardware and software equipment is supported and user-friendly.

The last indicator, also a barrier to fuller staff involvement in Kinkplatz, is the many hardware and line problems which still exist. The Vienna support-concept "Call Center" has its advantages, but a lot of disadvantages as well. This centralized system is slow and cumbersome, the waiting periods are long. Both IT specialists had two specific demands: "Firstly, we would appreciate it if the Call Center could react quickly because, that is not the case at the moment. Waiting periods of up to two weeks are the conse-

quences. Secondly, it would be easier for us to support the network if we were authorized to make simple hardware repairs and changes by ourselves." The whole system lacks flexibility.

Further factors impede effectiveness:

- The current situation of further ICT education (waiting periods of six months to one year). A lack of ICT knowledge is the negative result.
- The changing role of a teacher from an instructor to a coach and the new way to work with knowledge. "The teacher knows everything and the students know nothing," is an old adage that is loosing its validity.
- Lack of capacity in the labs.

What are the most positive and the most negative aspects and impacts of using ICT?

Positive aspects

- + ICT opens up new opportunities to develop valuable skills (team work, selforganization, being and working independently).
- + ICT is a strong catalyst for the students' motivation; therefore it is also easier for teachers to teach their students.
- + Start-up grant for entrance into a high school or a profession.
- + The working atmosphere in Kinkplatz is very good. The IT specialists and the principal are competent and friendly when they answer ICT-related questions from their colleagues, so the teachers dare to ask.
- + About 60-70 % of all students in Kinkplatz use a computer at home.

Negative aspects

- The social stratification divides the students into two groups: those who have and those who do not have a PC at home. One teacher said: "It is not possible for every student to use a PC at home because they often do not have one. Those students who have a PC at home have more ICT knowledge than the others." The school should

eliminate this social stratification but is presently not in a position to do so because there are too few ICT courses.

- Reduction of the whole education process to one item - ICT. The public equates modern education with ICT, and other pedagogical concepts are irrelevant.

Academic rigor

The prerequisite for teachers to use ICT in their teaching is that they feel comfortable with using a computer. Continuing further education and a PC at home are necessary. 80-90 % of the teachers have a computer and Internet access at home. All of them use PC and Internet in their teaching preparation and some use them for their teaching. Most of the teachers said that they get their ICT knowledge through private studies because the situation of professional development in Austria is unsatisfactory. That could be one reason why many teachers don't integrate ICT into their teaching.

Students have access to computers at school during the lessons but not without monitoring. Two students must always work together on one PC because of the situation in the labs (8 PC's per lab for 16 students). The average student spends 3-4 hours per week working with ICT during school hours. Some IT teachers provide a special educational ICT class once a week. Students can attend this lesson on a voluntary basis; there they can ask the teacher if they have questions. They often do their homework, write papers, surf the Internet and search for information. Foreign students often take advantages of these special classes. Motivation to learn with the new technologies is high as long as the content is not too difficult to understand and the student does not have too much to read. The amount of the information on the web pages often overtaxes students.

Equity

On the one hand, there are no differences between high and low income students in the school. Every student has the same access to ICT during the lesson. On the other hand,

the situation at home is not the same. High income students are more likely to have a PC and the Internet at home than the others. Low income students are therefore at a disadvantage in school because they lack ICT knowledge. Differences occur also between high and low ability students. As one teacher expressed it, "Students whose behavior makes a bad impression are often very interested in ICT." Language competence is a prerequisite meaningful ICT work. Students with language problems are at a disadvantage when using ICT. Some teachers mentioned that low ability students often work more slowly than high ability students. There are also gender differences when it comes to using ICT. Boys use PC's and the Internet more hours per week than girls. Girls often use the communication part of the Internet (chatting and sending e-mails) and create nice pages. Boys browse different Web pages than girls. Programming is typically a male domain.

Projections

Sustainability

What has to be done in Kinkplatz to maintain or improve the results of using ICT? The recommendations are the same as in other IT schools and can be divided into five categories.

1. Technical equipment

- Augmenting the existing equipment: each classroom should have at least two computers which are multimedia ready and connected to the Web and three laser printers.
- Regular replacement of the old technical equipment.
- Operating hardware and Internet access (that is not the case at the moment)

2. Organization

- Having one half-time IT specialist who manages the whole ICT system would be very helpful.
- Organizing access to the computer labs better would give every eacher the qpportunity to use ICT. This is only possible if there are two PC's per class.

3. Staff

- Well-educated staff members are essential. Further education has to be guaranteed for everyone.
- It is absolutely necessary to hire new, well-educated ICT eachers. The integration of the new staff members should be systematic, organized and geared to establishing a strong teaching team.
- The IT specialists who manage the support for staff and students should be better paid because they invest so much time in keeping the system working and are completely overworked.

4. Environment

- Growing number of homes with computer equipment.
- An ambitious goal is to introduce a network which will connect all the ICT secondary schools in Austria. The aim of this network should be for all ICT schools to achieve the same status as the music or sport secondary schools.
- More parental interest in ICT to support the students at home. Collaborative learning between students and parents can occur.

5. Education

- Constant evaluation of the current needs in ICT skills for high schools in order to ensure that graduates of a secondary school have the skills they need.
- Teachers should encourage their students to practice responsible computing, thus avoiding abuse. One ICT course should be "The Social Dimension of the Web".

Scalability

What efforts and resources are required for full implementation and what benefits can result from it? This question must be answered indirectly, because the interviews didn't contain the necessary data. The main points are the same as in other IT schools and are described below.

- The principal and the staff members must define a common goal which they will directly pursue. The whole staff should be firmly convinced that the school is on the right path.
- The authorities and the communities of the school have to support the efforts of the staff members not only by providing financial resources but also by creating the basic conditions necessary to act.
- Further trainings for staff members must be organized and supported in order to give teachers input on innovations and the opportunity to discuss pedagogical topics.
- All subject teachers should use ICT to the same degree their lessons; otherwise the students of teachers who don't use ICT in the lessons will be at a disadvantage compared to the students of teachers who use ICT. The individual philosophy of a teacher determines whether he/she is suited to implementing ICT into his/her teaching.
- In the words of the principal, "One benefit is that our children get basic training in a forward-looking medium."

Appendix A

Methodology

Description of the volume and type of data collected

Activity		Annotation	Amount
۲	erbal Interviews (approxi-		
mately 45-60 minutes each)			
	Nomination Form for a School	Principal	1
	Site		1
	Administrator Interview	Principal	1
	Parent/Guardian Interview	2 mothers, 2 fathers conducted as a group	1
		interview	1
	Technology Specialist Interview		1
	Student Interview	1 group of 5 students (fourth year)	2
	Student Intel view	1 group of 4 students (fourth year)	2
	Teacher Interview	4 teachers who were actively involved in and	
		strongly identified with the reform.	7
		3 teachers who were opposed to the reform.	

Questionnaire		
ICT Use Survey of Teachers	Teacher	15

Observing in classrooms			
	Computer science	Fourth year	
	English	Second year	
	Gymnastics	First year	

(Collecting additional materials	
	Web-site presentation	http://www.schulen.wien.at/schulen/914042/index.html
	Lesson plan from all classes	
	Reports on the experimental	Small class model
	school form	
	School profile	
	Number of students	From a fourth year
	Visions	School concept IHS
	New visions and projects	Chat-room and Web-cam

Appendix B

ICT Use Survey for Teachers

15 teachers filled out this questionnaire (n = 15). The results are represented in percentage (100 %).

• How comfortable are you with using a computer to do each of the following? (Choices are: very comfortable, comfortable, somewhat comfortable, not at all comfortable)

		very	com-	somewhat	not at all
		com-	fortable	com-	com-
		fortable	TOTADIC	fortable	fortable
1.	write a paper	66.7	26.7	6.7	-
2.	search for information on the WWW	26.7	40.0	6.7	26.7
3.	create and maintain web pages	-	14.3	14.3	71.4
4.	use a data base	26.7	20.0	40.0	13.3
5.	send or receive e-mail	60.0	13.3	-	26.7
6.	programming (e.g. writing a program in Visual BASIC or Java)	6.67	-	20.0	73.3
7.	draw a picture or diagram	26.7	33.3	20.0	20.0
8.	present information (e.g. use Power- Point or equivalent	13.3	20.0	26.7	40.0

• During the past school year, how often did your students on average do the following for the work you assigned? (Choices are: several times each week, several times each month, a few times, never)

		several times each week	several times each month	a few times	never
9.	use the World Wide Web	7.1	21.4	42.9	28.6
10.	create web pages	-	7.1	-	92.9
11.	send or receive e-mail	-	-	14.3	85.7
12.	use a word processing program	16.7	16.7	41.7	25.0
13.	use a computer to play games	-	-	64.3	35.7
14.	use a spreadsheet	-	14.3	28.6	57.1
15.	use a graphics program	-	14.3	50.0	35.7
16.	join in an on-line forum or chat-room	-	-	28.6	71.4
17.	use a presentation program (e.g., PowerPoint)	7.1	7.1	21.4	64.3
18.	use an instructional program (includ- ing simulations)	7.1	21.4	42.9	28.6
19.	other computer uses (specify)	-	21.4	14.3	64.3

20. How would you rate your ability to use a computer? (Choices are: good, fair, poor)

21.4	good
42.9	fair
35.7	poor

21. Was student computer use ever evaluated for grading? (yes-no)

6.7	yes
93.3	no

22. If you assigned World Wide Web searching, how much freedom did you allow stu dents in locating sites to visit? (no restrictions, some restrictions, designated sites only)

18.2	no restrictions
63.6	some restrictions
18.2	designated sites only

23. Did you create or modify a Web site with any of the classes that you taught? (yes-no)

7.1	yes
92.9	no

24. What portion of the computer use in your classes was directly related to the course content (as opposed to rewards or incentives, for example)? (all, most, some, very little)

-	all
38.5	most
30.8	some
30.8	very little

25. What portion of the computer use that you assigned is done by students individually? (all, most, some, very little)

	all
25.0	most
50.0	some
25.0	very little

26. How often did you use a computer at home for preparing for teaching? (several times a week, several times a month, a few times, never)

46.7	several times a week
40.0	several times a month
13.3	a few times
-	never

27. Did you participate as a student or instructor in a virtual course through the Internet/World Wide Web? (yes-no)

-	yes
100.0	no

28. Did you involve your students in collaborative learning over the Internet/World Wide Web with students from other classes? (yes-no)

_	yes
100.0	no

29. Are you currently using technology to collaborate with other teachers (professional chat rooms, forums, or the like)? (yes-no)

21.4	yes
78.6	no

30. How many e-mail messages total do you send and receive each day on average? (more than 12, 6-11, 1-5, none).

14.3	more than 12
28.6	6-11
35.7	1-5
21.4	none

31. Have you ever done any of the following? (Choices are: yes, no)

		yes	no
a.	made changes to a computer's hardware	57.1	42.9
b.	updated an application program (word processor, graphics pro- gram, etc.)	42.9	57.1
с.	recovered a damaged file	28.6	71.4
d.	created a Web site	21.4	78.6
e.	developed a data base	38.5	61.5

OECD/CERI ICT PROGRAMME

A Case Study of ICT and School Improvement at Secondary School, Wien-Steinbauergasse, Austria



January 27th, 2001

Overview of the present

Steinbauergasse secondary school, called "IHS Steinbauergasse", is located in the 12th district of the capital of Austria, Vienna. IHS stands for "Informatik-HauptSchule" and means secondary school for information technologies. The capital of Austria, Vienna, is situated in the eastern part of Austria and has about 1.600.000 inhabitants. In earlier times the 12th district of Vienna, called *Meidling*, where the school site is located, was a typical working-class district. Nowadays the population of *Meidling* has predominantly changed to foreigners, mainly emigrated from Eastern-European countries.

The secondary school for information technologies Steinbauergasse is a school for approximately 280 students, taught by 37 teachers in 11 classes. The number of teachers seems to be very high in comparison with other secondary schools in Austria. This peculiarity of IHS Steinbauergasse can be explained by the following: During the last years the new school concept of IHS Steinbauergasse has attracted a raising number of students. This new school concept is supported by three columns:

- ICT as a main emphasis in the curriculum for all four grades and also as a guiding
 principal of education in the classroom, and the basic idea is: "Our students do not
 need any computer equipment at home to gain good marks in ICT or ICT-oriented
 subjects".
- integrative classes, i.e. co-education of regular students and students with special needs in the same classroom. The use of ICT helps the students with special needs to take part in the classes in their way or even enables them to be taught the same subjects as the regular students. In one case a special computer equipment with two cameras is used as a seeing makeshift for one student with a severe visual disorder, so that he can take part in the classes.
- Full time support by offering lunch, homework assistance and arrangament of leisure time activities from 12.00 to 5.30 p.m. These facilities of IHS Steinbauergasse

62

are called "offene Schule", it means after school care for the children where both parents are working or come from broken homes.

Most of the students of IHS Steinbauergasse come from working-class families with problems like unemployment or unstable marriages. As a result of that and with the implementation of the above mentioned school concept the staff of IHS Steinbauergasse had to develop a very high social competence in the daily dealing with teenagers, who have special needs and often few social skills. And despite of the fact that the outward appearance and the equipment of IHS Steinbauergasse is very plain, the teachers have done excellent work.

Overview of the past

Many secondary schools in Vienna like Steinbauergasse secondary school deal with the problem of decreasing number of students because of a trend to send children between 10 and 14 years to a high school. The situation of some secondary schools was aggravated when emphasis on special skills in the school's curriculum led to competition among the secondary schools. So, a small team together with the principal thought about a solution to problem of decreasing student numbers and saw one way by promoting information technologies at their school site. Due to the social background of the students at the 12th district of Vienna this team saw good chances for increasing numbers of students by implementing an extensive offer to their "clients" with ICT, full time support and socially integrated classes. You can compare the changes at IHS Steinbauergasse to the changes at Kinkplatz.

Projection to the future

Principal and staff of Steinbauergasse secondary school are confident, that the changes in the school program and the offers made to the students will sustain the trend of increasing numbers. If investments are done both on ICT infrastructure and the building, Steinbauergasse can strenghten its position as an attractive alternative to both high schools and other secondary schools. Steinbauergasse could even get a good reputation that students from socially discriminated families get a solid preparation for future jobs.

To get more output at Steinbauergasse, additional computer labs and multimedia ready workstations, connected to the Web, would be necessary in each classroom. The answers of the staff at Steinbauergasse when asked about future projects are nearly the same as at Kinkplatz, because there are official and inofficial meetings of the responsible teachers and a close co-operation in developing the secondary schools for information technologies in Vienna.

Conclusion about key hypothesis

Hypothesis 1

Technology is a strong catalyst for educational reform, especially when the World Wide Web is involved. The rival hypothesis is that where true reform is found, technology served only as an additional resource and not as a catalyst, that the forces that drove the reform also drove the application of technology to specific educational problems.

The analysis of the collected data indicates that hypothesis 1 can be verified – with some restrictions (just as in other IT schools). In the case of Steinbauergasse social change was not planned, but the implementation of ICT was the beginning point of a social change. If the teachers had decided to install another point of emphasis like sports or music, this would probably also have been the catalyst for the reform. Therefore in our case ICT is one catalyst and the model of an "open school" is a further catalyst for school reform in Steinbauergasse secondary school. One primary prerequisite was a competent and dedicated team of teachers who ran the whole project. The majority of teachers expressed that a small team of teachers led and organized the whole process of innovation and has given support and will support further improvements. Without their dedication, change would not have been possible.

The use of ICT was found as one solution for the specific needs for change at Steinbauergasse. By having such a solution for educational reform, ICT functioned as a catalyst for immediate translation into action and the implementation of this concept can be seen in various steps.

Hypothesis 2

The diffusion of the reform (and therefore of ICT) followed the traditional diffusion pattern for reforms and innovations, as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and reforms and that therefore different diffusion patterns occur.

The diffusion of the organizational change followed the traditional diffusion pattern. ICT was the content of the changing process but it was at the start not the driving force of the change (just as in other IT schools). In the first step some ICT-interested teachers from several secondary schools in Vienna and responsible policy-makers discussed the actual situation. Both groups together have come to an agreement. The aim of the next years is to develop a concept (called IHS) concerning the implementation of ICT in secondary schools in Vienna. A project group was installed. This project group has worked out a new curriculum for ICT-schools, organizes the hard- and software purchase, gives support and functions as an information office (the same way as in Kinkplatz).

After developing an ICT concept the next task was to create enthusiasm for the new technologies among the fellow teachers. Some teachers were interested and attended several ICT-training courses, e.g. taking part in the teachers' training for information technologies at the Pedagogical Institute (PI). Only teachers, who have successfully taken part in those courses, are allowed to teach ICT subjects. Any newcomer to the staff at Steinbauergasse is asked to take part in this training in case he hasn't done so, so far.

A special diffusion pattern could be the so called "education highway" in Eastern-Austria (just like Grein). The education highway is a web-based education network where schools and other educational institutions can set up their own web pages and can look for information about schooling and education. The whole information concerning schooling and ICT is published on the education highway. In Vienna the education highway is also called "Vienna education server".

Hypothesis 3

Successful implementation of ICT depends mostly upon the technological infrastructure and student ICT competence rather than upon staff competence in the integration of ICT into instruction. The rival hypothesis is that teachers mediate such applications when they are successful, and that their academic value relates positively to teacher competence.

In fact, the rival hypothesis can be observed with the situation regarding the use of ICT. The more teachers are familiar and comfortable with using the ICT, the more they will use it for their teaching preparation and for their actual teaching. Without the necessary technical knowledge of the teaching staff the mediation of applications cannot be successful (just as in other IT schools). A very important role plays the professional development. Several teachers said that they had been willing ICT-professional training to undergo and they had applied at the PI and other ICT-training centres, but repeatedly they didn't get a place. Sometimes the ICT-trainings cover too large an area, or specific questions of highly involved teachers are not answered during the seminars.

The main fear of many teachers was that the students could have more technical expertise than themselves. A further change must take place - a change in their owns view. In this case teamwork is the magic word. Students and teachers have to constitute a team and then the process of learning can take place based on partnership.

Hypothesis 4

Gaps in performance between high and low poverty students will be enlarged rather than diminished where all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to high poverty students closing the gap with low poverty students. In the case of equal access to ICT the performance of the students depends on their personal interest and engagement. On the one hand, the condition of equal access to ICT can be satisfied during the lessons. But on the other hand equal access is not guaranteed at home where homework or several practices maybe have to be done. Therefore the pedagogical concept of Steinbauergasse never asks for homework being done by using a computer equipment. If homework is done on a computer, this is the free choice of the students.

Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

In fact academic standards are a combination of teacher and school expectations (just as in other IT schools). The teacher decides which teaching material will be used during the lesson. The task of the teacher is to sort out the beneficial material. If the teacher makes a selection of the beneficial ICT-teaching materials then the ICT will not lead to a lowering of academic standards. But if he or she allows the students to browse in the Web without any restrictions and without any selection of special web sites then one expects too much from students. The students are not able to understand all kind of information, which they find in the Web. Further more the students are not doing any homework by using a computer equipment, as the use of ICT is normally under control of their teachers. But the use of ICT might have changed something: language competence. Emails and chats have caused changes in the use of language. Sentences have become shorter, more full of specific vocabulary of the youths. Language teachers have their problems to instruct the students to use language correctly.

Characteristics of the school

Name of school site	Informatikhauptschule Steinbauergasse			
Address	A-1120 Wien, Steinbauergasse 27			
Phone / Fax	+43-1/813 75 80			
Web site	http://www.schulen.wien.at/schulen/912062/index.html			
E-mail address	hs12stei027k@m56ssr.wien.at			
Leadership	Headmaster: Mr. Franz Hartmann			
Number of classes	11 classes, a few of them as social integrates classes.			
Number of students	269			
Number of teachers	37			
Kind of school	Secondary school for students between 10-14 years			
Characteristics of school autonomy:				
School experiment	IHS: secondary school for information technology (offers to take a part of the examination in ECDL = European Computer Driving License) Socially integrated classes for students with special needs and full time support when required within the bounds of "offene Schule".			
Unusual features	IT in all 4 years 2 lessons a week. Besides subjects with creative work as balance to the technical subjects. A lot of extra classes are offered.			
Socially integrated classes	Some classes are taught to both (co-teaching of regular students and students with special needs)			
Special features of the school site:				
2 computer labs	8 PC's per lab, 3 Server, WINNT + WIN95 2 network-printers, 2 additional printers for administration, 1 scanner			
Internet connection	ISDN-LAN network (configuration see Appendix D) based on light wave conductor technology			
Neighbor school	In the same building at the back side there is another sec- ondary school, which is not an IHS.			

Evaluation of change

Diffusion patterns

About 15 years ago the idea of implementing new technologies arose by chance. A small ambitious team of teachers were privately interested in dealing with computers. The first steps were writing small computer programs. At that time a small team, con-

sisting of between two and five members, saw the enormous potential in the development of the new technologies even for the students of the secondary schools preparing for their future jobs. Before starting lessons at school, these interested teachers took part in a teacher training in order to qualify themselves. Together with the principal and the supervisory body of the department of education an additional concept for teaching the students even in computer science was made.

At the same time also other secondary schools of Vienna thought about computer science as a new subject. At least 14 school sites in Vienna took over the concept of an IHS. IHS Steinbauergasse was one of the last schools, which realized this concept. Both investments into hardware and hardware support and the curriculum for all 14 school sites were organized centrally. For hardware problems a call center, managed by a private company was installed, and for curriculum reasons a study group, consisting of teachers of each school site, was set up. The financial responsibility for investments and support in hardware were taken over by the respective department of education.

Staff development & involvement

To maintain the quality of trading with information technologies, most of the staff had to attend further trainings, organized by the PI (pedagogical institute), PÄDAK (pedagogical academy) or internally by each school site. New staff members for IHS Steinbauergasse should have teaching qualifications for information technologies. If not, they are asked to get the qualifications over within a short period of time. Apart from the offer of official institutions for further education in information technologies, the staff of IHS Steinbauergasse support themselves in many ways. The most important way to prepare the staff for the use of ICT was to get the acceptance of all members in implementing this main emphasis. This resulted in a high rate of interest in being prepared for teaching this special topic. To improve their skills dealing with the information technologies the staff asked questions and worked with ICT because of their own conviction. Help from colleagues or people outside of school raised their knowledge about ICT. Courses offered by the pedagogical academy or the pedagogical institute are important for staff members, who are not deeply involved with information technologies. Most of the time are useless for professional users of ICT because they deal with the topic in a very general way. The professional users would like more serious discussion of the specific topics they are interested in. This can be offered in internal courses, held by the regional advisor or another staff member of the school site, called SCHILF (schulinterne Lehrerfortbildung – internal further education of teachers). At the moment, these internal courses are held without remuneration.

Role of leadership

As mentioned in the chapter "diffusion patterns", a small team of teachers occupied themselves with the development in the field of computer technologies. This team thought about integration of information technologies into school subjects. A small computer net was established and 15 voluntary students were educated outside the normal lessons. The experiences with this experiment were discussed with the principal at that time and the responsible person at the department of education. A concept for implementation of information technologies at Steinbauergasse was developed and presented to the remaining staff. In a conference ³/₄ of staff voted for the implementation of the ICT-concept. The present principal only had to support and continue the on going project. He is lucky to have the initiators of the implementation process for some more time at his school site, which will ensure a permanent renewing process.

ICT-Reform Connections

Installing ICT at Steinbauergasse secondary school was the opportunity for the staff to develop a main point of emphasis at this school site. Secondary schools in Austria get more and more into competition among themselves and with high schools to maintain the number of students in each age-group. For "normal students" the use of ICT during
the lessons to prepare them for future professions is the strongest argument for this school site. On the other hand, students with special needs or students from socially discriminated families choose Steinbauergasse secondary school because of their socially integrated classes and/or full time after school care. Teaching ICT created new lessons and functioned as a motor of change at Steinbauergasse, the preoccupation with changing processes made the staff of Steinbauergasse more open to changes in general. The installation of new pedagogical concepts as "open learning" or "Montessori" was not only managed by teachers who were also involved into the implementation of ICT, but also often by teachers searching for alternative changes in their daily school life. The changing process not only contained subjects close to ICT, but nearly all subjects taught at Steinbauergasse. The students nowadays ask teachers to revice their pedagogical concepts. Therefore changes are not only required through outside circumstances. The use of ICT at school helps children to underline their wishes regarding changes in education and the behavior of teachers.

Outcomes

ICT Infrastructure

The following ICT infrastructure is situated in the secondary school of Steinbauergasse:

a) <u>Hardware</u>

Two computer labs contain one Server and eight Workstations each. All PC's are multimedia ready and connected to the Internet. One computer is situated in the principals' office, another one for administrative work for the head of leisure time activities. Additional computers can be found at the library and physics laboratory. Two network-printers at each lab, printers for the principal and head of leisure time activities are also available. One scanner and one digital camera, sponsored by Canon, are available at each IHS in Vienna.

b) Internet and Provider

Internet access is managed by an ISDN-LAN network. The education highway empowered by the authorities is the main provider for schools in the East of Austria. Wienstrom is the special provider for the Vienna schools (just as Kinkplatz).

c) Support

Two teachers, called "Kustoden", the IT specialists of the school, guarantee support for the teachers of Steinbauergasse in the same way as at Kinkplatz. But they are not authorized to change or repair any hardware by themselves. Even they don't know the password from the server to change something of the net-configuration. The hardware support of the whole ICT schools in Vienna is managed by the "Call Center". Technicians of the call center have to support the whole hardware (updating and repairing) as much as the net-configuration. Software support is managed in an other way. The both IT specialists of Steinbauergasse, are responsible for supporting teachers and students in software questions. They install the required software, normally standard programs of Microsoft Coorporation, which is a special sponsor of all IHS in Vienna. Small programs written by teachers or software products from other companies are serviced by the IT-specialists. For further details of hardware and software support on Vienna's IHS see Appendix E.

d) <u>E-mail</u>

One official school e-mail account has been established in the management department. At the moment there exists no official student or teacher e-mail accounts because of technical reasons. Official email accounts of Steinbauergasse can only be accessed to the school site. Several teachers are privately connected to the Internet. So they can only could read their e-mails at home, if they are supported by a special provider, the Telekom Austria. Some teachers and some students have therefore a private e-mail account. Especially for students the private e-mail-account is an advantage when they leave the school site. They can keep their adress. Teachers even can choose their provider, if they don't use an official e-mail account at the school site. These are the reasons, why practically spoken, there exists no official e-mail account system at Steinbauergasse.

e) System backup

The systems backup of the workstations is located at a special partition on each workstation. If there is a total crash, the IT-specialists can repair the configuration themselves by running a little batch-program from the backup-partition. The software has to be installed a second time. Daily work of teachers and students can only be stored on a ZIP-Diskette (100 MB), a data carrier for ZIP-Drives.

f) Use of ICT

Teachers and students use ICT for typewriting, projects, spreadsheet analysis, word processing, preparing and carrying out presentations, programming (logo), creating and maintaining web pages, drawing pictures or diagrams and searching information. Learning software is used in special subjects e.g. English, History (all the same as at Kinkplatz, because the curriculum has been made by a team of teachers from all over the 14 IHS of Vienna).

g) Special features at Steinbauergasse

The total number of PC's at Steinbauergasse is about 35 workstations. This differs from the number of officially counted workstations of 22 pieces. Some extra computers are mainly used for educating students with special needs. These extra computers are donations from caritative organisations and are not counted as part of the official equipment. Support and maintenance have to be organized by the teachers themselves. No money is given for this part of the computer equipment by the authorities.

Effectiveness

If you come as a visitor to secondary school of Steinbauergasse you get the impression, that the use of ICT is the normal case at this school site. The process of implementation is completed. For the whole staff there is no doubt at all, that it was the right thing to do so. The reform and the implementation of ICT help to maintain the school site against the threat of a decreasing student numbers and economizing measures of the authorities.

All of the teachers at Steinbauergasse try to think in a positive way about the use of ICT and they also make use of the technology to impart knowledge about it to their students or use it in their daily work (e.g. preparing their lessons or doing the whole administration on the PC).

During the implementation of the ICT at Steinbauergasse the staff attained a new quality of co-operation. The idea originated from a small team and diffused during a few school years into the whole teaching team and brought new goals and challenges to them. But not only the content of the lessons changed. That's more the position of teachers in the lessons changed. The students were no longer the ignored part of the lessons, teachers had to accept that they were experts in special fields as well. The knowledge of the students of ICT made the well-versed into assistents of the teachers. The role of the teachers also changed into learning apart of a lesson. But even other groups came closer together with the subject ICT: teacher and parents. Often parents ask the teachers for advice, when they want to buy some computer equipment for their children or have some troubles installing programs.

What are the most positive and negative aspects of ICT at Steinbauergasse?

Positive aspects:

- + The use of ICT at Steinbauergasse set a new goal for the teaching team: studentoriented lessons by raising equal opportunities and easier approach to jobs by imparting good basic skills.
- Improvement of teachers' training, because only examined teacher are legitimated to teach ICT-subjects.
- + Advantage for lessons: they get more realistic, alternative information sources for students are available (e.g. the teacher is no longer the only information source).
- + Knowledge about facts is not important any longer, but the way to get the right information: students have to be trained to get the right search results.
- + One's access to basic knowledge is much easier than decades ago.
- + Working with ICT demands structured and more precise working methods. The students' work improves in this aspect.

+ Working with ICT is nowadays a motivating factor, first of all for those students, who don't have any computer equipment at home.

Negative aspects:

- The profit from learning ICT skills could be much higher with a better equipment. Students at Steinbauergasse normally only can work in pairs with ICT at the computer labors. In the classroom normally the donated computers are for the handicapped students, not for including all students of a class. Half time at a computer signifies learning only half of what is needed to deal with ICT. For better effectiveness more computers in labs or in the classrooms are necessary.
- If you once made the decision to implement ICT at a school site, there is normally no way back to a life without it. Each of the interviewed teachers can't imagine this step back. But the more you implement ICT, the more you become dependent on it. In companies a lot of money is spent to take the necessary precautions of a 24 hours functioning of the equipment. A lot of money would be lost, if the ICT equipment does not work only for hours. At a school site the staff is also dependent on a ubroken availability of the equipment. But when failures occur, they only can react by calling the call center to report them. The staff will get reaction from the call center within two days, but normally repairing bok up to 14 days. The problem may lie in the centralistic organization of repairing ICT equipment on the secondary schools with information technology. If the IT-specialists of each school site got more competence for repairing the equipment and a better training on technical problems, the time for repairs would be shorter in any case. But at the moment there is not enough money to pay the extra time IT-specialists spend of a school site for service or to train them in a professional way.
- If you are dealing with ICT, you have to spend a lot of time by learning the various possibilities of use. Sometimes students lose their social contacts by being occupied with the computer too much. But on the other hand they have fewer job chances if they are not trained in basic skills of ICT. It is often a very difficult to steer a middle course.
- It is difficult for the staff to keep the curriculum up to date because of stipulated procedures when changing anything. Simplified procedures to implement the new

developments in this area would help to renew the curriculum according to the changed conditions.

Academic rigor

ICT is an important part of the school programm of IHS Steinbauergasse, which offers a lot of opportunities to come in contact with ICT. For further details look at the academic schedule at Appendix C. But the students have no free access to ICT. They only work with ICT during lessons or full time support in the afternoon monitored by a teacher. The access to the world wide web is not limited by technical precautions. The access of unwelcome web pages showing use of force or pornographic pictures is forbidden. The reason is discussed with the students and no problems occurred the last time.

On average, the students spend 3-5 hours a week with ICT, normally as mentioned in pairs because of the number of computers in the computer labs. Having access for several hours a week to ICT depends on the capacity of the available computers and academic schedule of the individual classes. One central idea of IHS Steinbauergasse is that all skills of ICT can be learned and trained at school. No computer at home is necessary to gain good marks. The situation for the staff is different. There are not enough computers at school to prepare lessons. Most of the teacher do their preparations at home. Therefore they need computers at home to work and learn with. At IHS Steinbauergasse about 70 % of the staff has a computer equipment at home. But in Austria they get no extra income to buy or maintain their "private" equipment.

Parts of MS Office, HTML-programming, CAD are conducted during lessons and learning software is sometimes used. The arrangement of the lessons even allow team teaching or co-education. The general knowledge of the students about ICT is high, because the results of ECDL-tests show nearly the same results as tests made by older students from high schools. Besides the prerequisite at school, where no use at home is obligatory, the grade of knowledge of the students depends first of all on the use of ICT at home by parents, brothers and sisters and themselves. In contrast to the teachers the share of students at IHS Steinbauergasse with a computer equipment at home is at a rough estimate about 25 - 30 %.

Equity

The staff at IHS Steinbauergasse can't find any difference between gender, high or low ability or high or low poverty students by using ICT. The greatest difference which can be discovered to the access of students to ICT is the availability of a computer equipment at home. Students with a computer at home are better skilled because of a greater amount of practice. The teachers said, that the property of a PC depends on the profession, interest and attitude of the parents. But several other studies in Austria show that low income families have significantly fewer PC's at home than families with higher incomes.

Projections

Sustainability

Maintaining Steinbauergasse secondary school is not only related to ICT use at this school site. Based on the good work of the principal and the staff, two great fields have to be developed: ICT and the infrastructure of the building. As mentioned and seen on the picture at the first page, the building is over 100 years old and has to undergo a complete renovation. Not only the outward appearance of the building, also a better distribution of the rooms and also the extension of the cellar and improving the attic would help improving social skills. On the other side the ICT equipment is not enough for a school site with ICT as a main emphasis. Besides a third computer lab, at least two workstations with access to the World Wide Web each class and more workstations for the teacher to work with at school are necessary. Even a second digital camera would be desirable. The staff is motivated to sustain the process of development. The acceptance

of ICT is very high and the majority of the staff is involved with it. Due to personal interest and further education the staff feels prepared for educating their students. At that time changes of the current situation are formulated more as wishes than as claims. If there is only little help from outside, the process will make no progress in the near fiture.

Scalability

As a result of the above statements, the efforts to complete a full implementation of ICT at IHS Steinbauergasse should be made in investments on further workstations in the same number as already existing. This means a third and fourth computer lab for parallel education of two classes in information technologies, where each student has his own workstation to work with. To use ICT even in other subjects besides information science two workstations each per classroom with access to the Internet are necessary. The required volume for this necessary investment is about the same as the investments carried out until now. These investments will result in better ICT access for the students and thus a wider use in any subject. The personal ressources at Steinbauergasse for a wider use of ICT are available.

But ICT is only one facet of the whole school concept of Steinbauergasse. The renovation of the whole building might be more urgent at the moment to raise well-being at school both for teachers and students than on investment into new computer equipment. The identification with the school site will be of more value than any equipment could do.

Appendix A

Methodology

Description of the volume and type of data collected

Activity	Annotation	Amount
Verbal Interviews (approximately		
45-60 minutes each)		
Nomination Form for a School	Principal	1
Site		1
Administrator Interview	Principal	1
	representative of parents' club	
Parents/Guardian Interview	2 mothers at school	5
	2 mothers interviewes on the telephone	
Technology Specialist Interview	both IT specialists are full-time teachers	2
Student Interview	1 group with 6 students (third year)	2
Student Interview	1 group with 5 students (fourth year)	2
Teacher Interview		5

Questionnaire		
ICT Use Survey of Teachers	Teacher	11

(Observing in Classrooms		
	Computer science (computer la- bor)	fourth year	1
	Biology	fourth year	1
	German	third year (use of ICT to support a seri- ously seeing handicapped student)	1

(Collecting additional materials	
	Web-site-presentation	http://www.schulen.wien.at/schulen/912062/index.html
	Lesson plan at all classes	Appendix C
	Reports on the schoolattempt	Offene Schule (full time support for students)
Sahaal profile		His-steinbauergasse.ppt (presentation of the school site
	School prome	by a students work)
	Visions	School concept IHS
		Connecting all classes to the web
	New visions and projects	Redevelopment of the whole building including techni-
		cal infrastructure; extension of cellar and attic to make
		more space for additional education concepts

Appendix B

ICT Use Survey for Teachers

11 teachers filled out this questionnaire (n = 11). The results are represented in percentage (100 %).

• How comfortable are you with using a computer to do each of the following? (Choices are: very comfortable, comfortable, somewhat comfortable, not at all comfortable)

		very com- fortable	com- fortable	somewhat com- fortable	not at all com- fortable
1.	write a paper	63.6	36.4	-	-
2.	search for information on the WWW	36.4	36.4	18.2	9.1
3.	create and maintain web pages	-	9.1	9.1	81.8
4.	use a data base	10.0	30.0	30.0	30.0
5.	send or receive e-mail	45.5	54.5	-	-
6.	programming (e.g. writing a program in Visual BASIC or Java)	-	9.1	27.3	63.6
7.	draw a picture or diagram	9.1	45.5	36.4	9.1
8.	present information (e.g. use Power- Point or equivalent	-	10.0	20.0	70.0

• During the past school year, how often did your students on average do the following for the work you assigned? (Choices are: several times each week, several times each month, a few times, never)

		several times each week	several times each month	a few times	never
9.	use the World Wide Web	11.1	22.2	33.3	33.3
10.	create web pages	-	-	11.1	88.9
11.	send or receive e-mail	-	22.2	-	77.8
12.	use a word processing program	33.3	22.2	22.2	22.2
13.	use a computer to play games	-	11.1	44.4	44.4
14.	use a spreadsheet	-	33.3	22.2	44.4
15.	use a graphics program	-	22.2	33.3	44.4
16.	join in an on-line forum or chat room	-	11.1	55.6	33.3
17.	use a presentation program (e.g., PowerPoint)	-	-	22.2	77.8
18.	use an instructional program (includ- ing simulations)	-	44.4	33.3	22.2
19.	other computer uses (specify)	-	22.2	44.4	33.3

20. How would you rate your ability to use a computer? (Choices are: good, fair, poor)

-	good
75.0	fair
25.0	poor

21. Was student computer use ever evaluated for grading? (yes-no)

40.0	yes
60.0	no

22. If you assigned World Wide Web searching, how much freedom did you allow students in locating sites to visit? (no restrictions, some restrictions, designated sites only)

-	no restrictions
85.7	some restrictions
14.3	designated sites only

23. Did you create or modify a Web site with any of the classes that you taught? (yes-no)

-	yes
100	no

24. What portion of the computer use in your classes was directly related to the course content (as opposed to rewards or incentives, for example)? (all, most, some, very little)

-	all
11.1	most
55.6	some
33.3	very little

25. What portion of the computer use that you assigned is done by students individually? (all, most, some, very little)

-	all
25.0	most
50.0	some
25.0	very little

26. How often did you use a computer at home for preparing for teaching? (several times a week, several times a month, a few times, never)

40.0	several times a week
40.0	several times a month
10.0	a few times
-	never
10.0	no computer at home

27. Did you participate as a student or instructor in a virtual course through the Internet/World Wide Web? (yes-no)

10.0	yes
90.0	no

28. Did you involve your students in collaborative learning over the Internet/World Wide Web with students from other classes? (yes-no)

-	yes
100	no

29. Are you currently using technology to collaborate with other teachers (professional chat rooms, forums, or the like)? (yes-no)

30.0	yes
70.0	no

30. How many e-mail messages total do you send and receive each day on average? (more than 12, 6-11, 1-5, none).

10.0	more than 12	
20.0	6-11	
70.0	1-5	
-	none	

31. Have you ever done any of the following? (Choices are: yes, no)

		yes	no
a.	made changes to a computer's hardware	30.0	70.0
b.	updated an application program (word processor, graphics program, etc.)	40.0	60.0
с.	recovered a damaged file	40.0	60.0
d.	created a web site	-	100
e.	developed a data base	30.0	70.0

Appendix C

IHS Steinbauergasse, Vienna

Number of weekly hours per class subjects 1st 2nd 3rd 4th **Religions education** German English History and Geography Mathematics, Geometry Biology Physics Musical Education Creative Work Housekeeping Physical education Information technologies

Academic schedule

Extra classes: Additional Information Science Football (soccer) (French Biological practice Chemical practice ECDL (3rd/4th class) Commercial practice Conversation practice

(2 teams for boys and girls each)

Appendix D

Net-configuration of IHS Steinbauergasse



Appendix E

Organisation of ICT-Support for IHS in Vienna



OECD/CERI ICT PROGRAMME

A Case Study of ICT and School Improvement at

Secondary School, Hall, Austria



February 10th, 2001

Introduction

The principal reported on an important new regulation which will effects all the teachers, the principal, and the carrying out of this study. Every teacher in Austria will expected to attend either in-house or outside courses in ICT by December 31, 2002. With the knowledge acquired, every teacher should use ICT and integrate it into his/her teaching. A further mandatory requirement is that all school districts in Austria provide their schools with Internet access by December 31, 2001. This news came on short motice, so the general reaction was one of fear or reservations. There is a simple reason for this: Teachers are ready and willing to get further education in ICT, but the basic conditions are wrong. The PI (Pedagogical Institute) offers too few ICT courses to satisfy the demand. As a result, there are long waiting periods and frustration on the part of those forced to wait. To summarize, the general attitude toward ICT has rapidly deteriorated.

The deterioration of ICT working atmosphere also had consequences for the executing of the interviews and the filling out of the questionnaires. Some teachers refused to do an interview or to fill out a questionnaire. The principal and teachers interested in IT, however, were very helpful in supporting this study, and in the end, ten of the school's 28 teachers filled out the questionnaire.

Overview of the present

Hall is a small historical city situated 10 km east of Innsbruck, the capital of Tyrol. Hall, which is known throughout Austria for its beautiful old town and its medieval flair, has 12,314 inhabitants. The social stratification is varied, with occupational groups ranging from hourly workers to EU commissioners. The secondary school of Hall is located in the center of the old town. In the 2000/2001 school year, it had 268 students (154 male; 114 female) aged 10 - 14 taught by 28 teachers (14 male; 14 female). Students and teachers participate in some European projects (e.g. the "Comenius project") and work together with several sites of other countries, e.g. Italy, Spain and Finland. Therefore

the school administration created a new name for the school: "Europahauptschule Hall" or "European secondary school of Hall".

This school offers two pedagogical areas of emphasis: languages and ICT. The language emphasis should help to remove the language and cultural barriers in the minds of the students. Languages intensify political and cultural contacts and offer the necessary prerequisites for a successful professional life. Until a few years ago, language was the only emphasis at this school. Two of three classes were conducted as special language classes, and one class was conducted as a "normal" secondary school. The logical consequence was that high ability students attended the special language classes, while low ability students had to choose the "normal" class because they couldn't pass the language class. The "normal" classes were devalued. The principal and his team saw need for action. ICT was the buzzword, and the new emphasis was created in 1999. The second pedagogical concept at this school is based on ICT. There are two computer-labs with 13 desktop computers per lab and four classes with one stand-alone PC. All PC's in the labs are connected to the Web and are integrated into two ISDN-LAN-networks (10 Mbit and 100 Mbit). The staff created an extraordinary curriculum for ICT with a special schedule for each of the four years (the same as in other ICT schools). The local school board approved this self-initiated school-program and provides the additional funding for the staff and the municipality of Hall provides the funding for the necessary hardware.

The newly established ICT emphasis has attracted many students, and by the beginning of the school year 2000, two consequences were noticeable. Firstly, some of the students who applied for this ICT emphasis were toying with the idea of attending the neighboring high school. Secondly, more students applied for the ICT than the languages emphasis. The principal therefore decided to conduct one and a half classes with an ICT emphasis and the other one and a half classes with a languages emphasis. As the IT specialists and the principal put it, "The attractiveness of ICT is impressive and amazing."

Overview of the past

The language classes are conducted very successfully and have a good reputation. Because the number of applications often exceeded the capacity of these classes, the "normal" class was seen as less desirable. In fact, the main problem of the European secondary school was the bad reputation of the "normal" class, which handicapped students and teachers. In an effort to increase the reputation and value of the "normal" class, the principal and a small team of teachers decided to establish a new ICT emphasis starting in 1999. A further goal is to provide students with ICT skills, thus fulfilling the expectations of the economy and advanced schools.

The first step toward establishing an ICT emphasis was to install all the hardware and software. This school maintains close contacts with the municipal authority that provides the necessary hardware, and these good contacts opened up the possibility to share a common ICT project "Hall vernetzt" or "Hall connected". The aim of this project was to integrate all the public institutions of Hall into an ICT network. The European secondary school functioned as test object, with the municipal authority and private institutions providing the computers and lines for the school. Teachers and students worked together to lay all the lines in the school and install all the computers by themselves during their vacation. The integration of students into the installation process was a great success because the students were engaged, interested and got practical experience with hardware and software. The main key to the success of this school project was the unusually high level of engagement of a small teacher team and the many unpaid hours they invested (the same as in other ICT-schools).

One teacher took over the leadership role, dealing with computers (hardware and software) early on. Little by little, he tried to get more and more teachers with enthusiastic about the new technologies. Some teachers were suspicious of the new technologies and fearful of the uncertainties. The main fear of many teachers was that the students might have more technical expertise than they themselves. Professional development was based on two concepts: external and in-house ICT trainings. One great problem occurred at this stage: teachers showed willingness to take ICT courses, but the demand cannot be satisfied despite the PI's increasing the number of special ICT trainings it offers each year (just the same as in other federal provinces). The two IT specialists from the school organized in-house ICT courses, training their colleagues and giving them support. Some teachers who were interested in ICT attended further trainings and passed the ICT examination.

Projections for the future

What remains to be done to complete the whole process? First of all, every class should be equipped with at least one or two PC's which are multimedia ready and connected to the Web. These PC's will function as an information pool in every classroom. Every teacher should have the possibility to use a PC and the Internet directly in the classroom during his teaching. These additional investments will help compensate for capacity problems in the labs. A second goal is to get old PC's, for example those that banks are replacing. The students might remove valuable components from these old PC's and put them together to make more powerful PC's. This kind of work will provide the handson experience which the business world demands. The third goal is to connect the whole school building with a 100 Mbit-network. Another necessity is for the school to keep and hire IT specialists and ICT-trained teachers who will maintain and improve the present situation. And last but not least, the dream of the two IT specialists is to have a system administrator who supports the whole network and the teachers. One of the two IT specialists would like to reduce his teaching hours and take over the duties of a system administrator. This would relieve the IT specialists, who are completely overworked.

The main indicators of success that could be filtered out are the same as in other ICTschools:

- Self-initiative and engagement of a competent teacher team
- Readiness of the proper authorities to change legal conditions to allow the implementation of self-initiated academic programs with an intensive focus on ICT
- Funding for the entire ICT project (hardware and software) and human resources throughout the whole process

- A school program containing goals, instructions, extraordinary curriculum and schedules
- Financial resources for additional rooms (labs, classroom)
- Openness to change among the whole staff

Conclusion about key hypotheses

The following hypotheses draw considerable parallels between this school and the other secondary schools in our sample.

Hypothesis 1

Technology is a strong catalyst for educational reform, especially when the World Wide Web is involved. The rival hypothesis is that where true reform is found, technology serves only as an additional resource and not as a catalyst, and that the forces that drove the reform also drove the application of technology to specific educational problems.

The analysis of the data collected indicates that hypothesis 1 can be verified – with some restrictions (just the same as in other ICT-schools). That means in the case of Hall, the implementation of ICT was not a planned social change but the start of a social change. If the teachers had decided to create another main emphasis like sports or music, that would probably have triggered the reform. Therefore, in this case, ICT and the language emphasis were both catalysts for school reform in the secondary school of Hall. The main condition is that a competent and engaged team of teachers oversee the whole school approach. The majority of teachers confirmed that a small team of teachers oversaw and organized the whole innovation, provided and continues to provide support, and will develop further improvements. Without their wholehearted engagement, the process of change is not possible. The use of ICT was identified as one solution for the specific need for change in Hall. As the solution for educational reform, ICT was the catalyst that allowed the plan to be put immediately into action.

Hypothesis 2

The diffusion of the reform (and therefore of ICT) followed the traditional diffusion pattern for reforms and innovation as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and reforms and that different diffusion patterns therefore occur.

The diffusion of the organizational change followed the traditional diffusion pattern. ICT was at the heart of the change process, but at the start it was not the driving force of the change (just the same as in other ICT schools). In the first step, the principal and teachers interested in ICT discussed the current situation. The result of this conversation was clear: There was a need to establish new emphasis which would attract students but also fulfill the demands of the business world and the advanced schools. The focus would be on creating a concept for the implementation of an ICT emphasis. Two teachers took over the leadership role. They organized the hardware and software installation, provided support, trained their colleagues, and increased their interest in ICT. Only a fraction of teachers passed the ICT examination. With the technical expertise they acquired, these teachers were able to teach ICT subjects and integrate ICT into their teaching. Until the basic conditions change, convincing the majority of the teaching staff will be difficult.

A special diffusion pattern in Tyrol could be the so-called "TIBS: Tiroler Bildungsserver" or "Tyrolean Education Server" which is comparable to the "Education Highway" in Upper Austria and Vienna. "TIBS" is a Web-based education network where schools and other educational institutions can post their own web sites and search for information about schooling and education. "TIBS" also offers e-mail accounts for teachers, students and school administrations.

Hypothesis 3

Successful implementation of ICT depends mostly upon the technological infrastructure and student ICT competence rather than upon staff competence in the integration of ICT into instruction. The rival hypothesis is that teachers mediate such applications when they are successful, and that their academic value relates positively to teacher competence.

In fact it is the rival hypothesis that applies to the situation regarding the use of ICT. The more familiar and comfortable teachers are with using ICT, the more they will use it for their teaching preparation and for their actual teaching. If the teaching staff lacks the necessary technical knowledge, the mediation of applications cannot be successful (just the same as in other IT schools). One IT specialist mentioned a case which verifies this hypothesis. A teacher of religious education started an ICT religion project designed to give the religion lesson a special character. She took a photograph of every statue of a saint in Hall's church with a digital camera. Afterwards, she posted the photos with special commentaries on the Web so everybody, including her students, could take a virtual tour of the church. She acquired the knowledge necessary through external courses and the help of the IT specialists. Without the technical expertise, she could not have carried out this project by herself.

Professional development plays a very important role because the main fear of many teachers was and is that the students might have more technical expertise than they themselves do. Several teachers said that they were willing to pursue ICT professional development and they had applied at the PI and other ICT trainings, but the courses were always full. There is an urgent need to change this situation, which has had another consequence: Some teachers have acquired the technical expertise they apply in their teaching on their own, e.g. through the Web or reading technical literature. To quote one IT specialist: "Through the self-study in the Web, I find the latest news, which I integrate directly into my teaching. Therefore my students are informed about the latest technical advances." This kind of teaching is not possible unless the teacher **i** informed and well-educated.

Hypothesis 4

Gaps in performance between high and low income students will be enlarged rather than diminished where all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to high poverty students closing the gap with low poverty students.

In the case of equal access to ICT, students' performance depends on their personal interest and engagement. The condition of equal access to ICT is satisfied, on the one hand, during the lessons. But on the other hand, equal access is not guaranteed at home, where homework or exercises have to be done (just the same as in other IT schools). Engaged and interested students find ways to use computers outside the school, e.g. meeting classmates who have a computer at home, but the competition conditions are not the same.

The teachers of Hall estimated that 50 - 90 % of their students have a PC at home. Having or not having a PC in Hall depends on two issues: the social stratification and the main emphasis of the class the students attend. Most of the students from the ICT emphasis have their own PC at home and all ICT students have a private school e-mail account because the first-year curriculum includes Web communication, e.g. the use of e-mail, sending SMS's and chatting.

Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

In fact, academic standards are a combination of teacher and school expectations. One IT specialist reported: "Yesterday, I showed my colleagues a web site with 5,000 prepared worksheets. The teacher just has to decide which teaching material to use during the lesson. These undreamed-of possibilities didn't exist in the past." The task of the teacher is to choose the material that will be beneficial. If the teacher selects good ICT teaching materials, then ICT will not lead to a lowering of academic standards. On the other hand, if he or she does not pre-select special web sites and allows the students to browse the Web without any restrictions, many students will be overtaxed because they will not be able to understand all the information they find. As one IT teacher put it: "Students with high ability, good linguistic proficiency and self-organization are the winners when it comes to the new technologies because the others are often lost in the maze and completely overtaxed."

Characteristics of the school	
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Name of school site	Europahauptschule Hall
Address	A-6060 Hall in Tirol, Bachlehnerstraße 2
Phone / Fax	+43-0 52 23/45 0 24
Web site	http://www.euhs-hall.tsn.at
E-mail address	direktion@euhs-hall.tsn.at
Administration	Principal: Mr. Wilfried Hammer
Number of classes	12
Number of students	268 (154 male, 114 female)
Number of teachers	28 (14 male, 14 female)
Kind of school	Secondary school for students between the ages of 10 and
	14
Characteristics of school autor	nomy:
	ICT: Secondary school for information technology (offers
	part of the examination in ECDL = European Computer
School experiment	Driving License)
	Language: The students have the possibility to choose three
	languages (Italian, English, French).
	IT in the 1 st year (1 lesson a week)
	Typing in the 1 st year (1 lesson a week)
	Information about professions in the 3 rd and 4 rd grade (1
Unusual features	lesson per week)
	Participation in the EU "Comenius Project", the "OKO-
	Audit-Project" and many IT projects e.g. "Netdays",
	"ENIS"
Peculiarities of the school site	
	13 PC's per lab (WIN95, WIN98 and WINNT)
2 computer labs	2 servers (Linux)
	16 printers (3 laser printers, 13 ink jet printers)
	1 digital camera, 1 Web camera and 2 scanners
Further PC's	4 PC's only for teachers and administration
Internet connection	2 ISDN-LAN networks (100 Mbit-net and 10 Mbit-net)
Architecture	Old building in the center of Hall which is overcrowded.

Evaluation of change

Diffusion patterns

The principal and a teacher decided to introduce ICT as second emphasis in an effort to upgrade the reputation of the "normal" class. Both the school's IT specialists co-operate with the "TIWAG" which is a large IT company in Tyrol. One of the TIWAG's goals is to connect public institutions of Tyrol to the Web. Public institutions handle sensitive and confidential data, so the secondary school is well qualified to function as test system. Both partners, the TIWAG and the school, benefited from this cooperation. A further diffusion pattern was the project "Hall Connected". The municipal authority of Hall started this project, which connected all the public institutions of Hall to the Web. Again, the secondary school of Hall served as the forerunner. Today, all Hall's public institutions are integrated into an ISDN network, so the school's network works extremely well. Further diffusion patterns are the same as in other IT schools. There was a small team of teachers who initiated, organized and oversaw the introduction of ICT. The authorities support and finance the entire concept, providing and supporting the technical infrastructure and last but not least encourage professional development.

Staff development and involvement

At present, the main problem in Tyrol is that there are not enough ICT trainings (just the same as in other federal provinces). The teachers want ICT development, but most trainings are full. As a result, there are long waiting periods for courses, and teachers are frustrated. For that reason, Hall's two IT specialists have trained and coached their colleagues voluntarily, in their free time and without pay, but that was a drop in the bucket. Both IT specialists mentioned a second point: "Advanced trainings, e.g. supporting an ICT network, are not offered by the PI. These kinds of courses are very expensive, and the authorities won't pay for them." Some years ago, one IT specialist took a sabbatical

year and worked as programmer at a private IT company. With the knowledge he acquired, he is now in a position to install and support the network. The other IT specialist is gaining technical expertise on his own during his leisure time. But what would happen if both IT specialists left the school? Nobody knows the answer.

Role of leadership

One engaged teacher who was interested in ICT took the preliminary steps. The principal and his team were responsible for implementing this school experiment and oversaw the entire ICT installation and staff development. These key persons also determined the next steps for the future (just the same as in other IT schools).

ICT reform connections

The negative image of the "normal" class was the starting point for establishing the new ICT emphasis. The majority of teachers believed that ICT was trend-setting and necessary because it gives the students the opportunity to acquire ICT basic qualifications which the business world and advanced types of school demand.

Outcomes

ICT Infrastructure

The following ICT infrastructure is situated in the secondary school of Hall:

a) <u>Hardware</u>

Two computer labs with 13 PC's per lab. All PC's are multimedia ready and connected to the Internet. Four computers are situated in the main office and the conference room. Additionally 16 network printers (3 laser and 13 ink jet), two scanners, one digital camera and one Web camera are available.

b) Internet

Internet access is managed by two ISDN networks (10 Mbit and 100 Mbit).

c) Support

Both IT specialists installed the entire hardware and software and provide support for their colleagues and the network. If possible, teachers repair defective hardware themselves. In fact, both IT specialists invest a lot of time keeping the system running and they are completely overtaxed and underpaid.

d) <u>E-mail</u>

One official school e-mail account was set up for the main office. Every teacher and every student in the ICT emphasis classes has a private school e-mail account which they use during the lessons.

e) System backup

The backup of the system and the configuration is made by a streamer tape, but this is done on an occasional, not regular basis. Data created by teachers and students is not automatically saved. It is the responsibility of teachers and students to save the data they produce themselves.

f) Use of ICT

Teachers and students use ICT for typing; in projects, spreadsheet analysis, word processing; in preparing and making presentations; for programming, creating and maintaining Web pages, for drawing pictures or diagrams, and to search for information. Learning software is used in special subjects e.g. English.

Effectiveness

The results of Hall show the same indicators of success as the other IT schools:

- Well-educated, engaged and interested staff members are absolutely necessary to integrate ICT successfully.
- Teachers' attitudes and the conviction that they are on the right path is essential.
- Setting goals is important.

 Providing the necessary hardware and software for using ICT: Many teachers in Hall complained that both labs are always occupied. Teachers will not be able to integrate ICT into their teaching if the hardware and software is not available, supported and user-friendly.

Further factors impede the effectiveness (just the same as in other IT schools):

- The current situation of further ICT education (waiting periods of six months to a year). A lack of ICT knowledge and frustration are the negative results.
- The main fear of many teachers is that the students might have more technical expertise than themselves.
- The changing role of a teacher from an instructor to a coach, and the new ways to work with knowledge. "The teacher knows everything and the students know nothing," is an old adage that has lost its validity.
- Lack of capacity in the labs.

What are the most positive and the most negative aspects and impacts of using ICT (just the same as in other IT schools)?

Positive aspects

- + ICT opens up the opportunity for students to develop valuable skills (team work, self-organization, being and working independently). These are good prerequisite skills for entrance into a high school or a profession.
- + ICT is a strong catalyst for the students' motivation; therefore it is also easier for teachers to teach their students.
- + 50-90 % of the students in Hall use a computer at home. It depends on which emphasis the students attend.
- + Handicapped students easily make friends with normal students in chat-rooms and via e-mail because, as one teacher expressed it, on the Web, the other person's mtionality, race, gender and appearance don't matter.

Negative aspects

- Internet-addiction: Some teachers expressed their anxiety. As one IT specialist put it: "I installed a server and programmed a special chat-room called "The Palace", which my students often use. I can observe the Palace, and I know exactly who is chatting at any given time because the students have to log in with an account. The same students often chat in the Palace for several hours. That is really alarming."
- Students' motivation to learn: The students are very motivated to learn if they are allowed to use ICT. ICT takes over the part of an entertainer, but if the teacher has no possibility to use ICT, students are often not motivated to learn.
- The social stratification divides the students into two groups: those who have and those who do not have a PC at home. The school should close the gap between the social stratification, but is currently not in a position to do that because there are not enough ICT courses in the curriculum.

Academic rigor

The prerequisite for teachers to use ICT in their teaching is that they feel comfortable using a computer (just the same as in other IT schools). Continuous further education and a PC at home are necessary. "80 -90 % of Hall's teachers have a computer at home," the principal estimated. What percentage use ICT regularly during their teaching? One IT specialist estimated: "20 % of the entire teaching staff," and explained this small percentage as follows: "The main problem is having an Internet connection and not having a PC at home, because anybody who cannot use Internet at home will never acquire the necessary technical expertise to integrate ICT into his/her teaching. There are two reasons for the low number of Internet connections at home: first, a lack of technical expertise and second, the cost." Many of the teachers use the PC for their teaching preparation, and some of them use it in teaching. Most of the teachers said that they get their knowledge about ICT through private studies because the situation of professional development in Austria is unsatisfactory.

Students can access computers in the school during the lessons, but not without monitoring. The average student spends three hours per week using ICT during school. Some teachers pointed that depends on the teacher how many hours a week students work with ICT. The teachers who teach the same subject, for example English in the same grade don't use ICT to the same degree in their lessons. The motivation to learn with the new technologies is high if the content is not too difficult to understand and the student does not have too much to read. Students are often overwhelmed by the information on the Web pages. One unique school project was carried out in the early stages of establishing the new ICT emphasis: Teachers and students worked together to lay the lines in the entire school building and install all the PC's in the labs during their vacation. The students were enthusiastic about the practical experience they acquired.

Equity

Differences occur between high and low ability students. One teacher summed it up like this: "The winner of the new technologies are highly intelligent students who have language competence and good self-organization skills, because they can browse the Web without losing their orientation and they understand the content. Students who don't have these abilities often have a poor work habits. They are often overtaxed and lose their way in the Web." Gender differences also exist in ICT use. Boys use PC's and the Internet more hours per week than girls. Girls often use the communication part of the Internet (chatting and sending e-mails) and create nice pages. Boys play more computer games than girls. They also browse different web sites than girls, for example girls often search for movie stars, while boys tend to search for sex and game-pages. Differences occur also between high and low income students - not in school, but at home. High income students are more likely to access to a PC and the Internet at home than the others (just the same as in other federal provinces). Low income students therefore are at a disadvantage at school because they lack ICT skills.

Projections

Sustainability

What has to be done in Hall to maintain or improve the results of using ICT? The recommendations are the same as in other IT schools and can be divided into five categories.

1. Technical equipment

- Augmenting the existing equipment: each classroom should have at least one or two computers which are multimedia ready and connected to the Web. The old lab should be upgraded from a 10 Mbit to a 100 Mbit network, and last but not least, the lab should have a beamer.
- Regular replacement of the old technical equipment.

2. Organization

- Having one half-time IT specialist to manage the whole ICT system would be very helpful.
- Organizing access to the computer labs better would give every teacher the ϕ -portunity to use ICT. This is only possible if there are two PC's per class.

3. Staff

- Well-educated staff members are essential. Further education has to be guaranteed for everyone.
- It is necessary to hire and keep new, well-educated ICT teachers.
- The IT specialists who manage the support for staff and students should be better paid because they invest so much time in keeping the system working and are completely overtaxed.

4. Environment

- If the Federal Ministry set new goals concerning ICT, the persons responsible will have to provide the necessary basic conditions. E.g. if every teacher has to attend ICT courses by December 31, 2002, then the responsible authority must provide sufficient ICT courses.
- More parental interest in ICT to support the students at home. One teacher put it this way: "In low income families, the PC sometimes serves as an instrument to keep the students busy and quiet."

5. Education

- Constant evaluation of the current needs in ICT skills for high schools in order to ensure that graduates of a secondary school have the skills the need.
- Teachers should encourage their students to practice responsible computing, thus avoiding abuse. One ICT course should be "The Social Dimension of the Web".
- Openness to ICT further education among the whole staff

Scalability

What efforts and resources are required for full implementation and what benefits can result from it? This question must be answered indirectly, because the interviews didn't contain the necessary data. The main points are the same as in other IT schools and described below.

- The principal and the staff members must define a common goal which they will directly pursue. The whole staff should be firmly convinced that the school is on the right path.
- The authorities and the communities of the school have to support the efforts of the staff members not only by providing financial resources but also by creating the basic conditions necessary to act.

- Further trainings for staff members must be organized and supported in order to give teachers input on innovations and the opportunity to discuss pedagogical topics.
- All subject teachers should use ICT to the same degree their lessons; otherwise the students of teachers who don't use ICT in the lessons will be at a disadvantage compared to the students of teachers who use ICT. The individual philosophy of a teacher determines whether he/she is suited to implementing ICT into his/her teaching.
- Teachers who are currently opposed to the reform should be convinced of the absolute necessity of the new technologies and that there is no getting around them.

Appendix A

Methodology

Description of the volume and type of data collected

Activity	Annotation	Amount
Verbal Interviews (approximately 45-60 minutes each)		
Nomination Form for a School Site	Principal	1
Administrator Interview	Principal	1
Parent/Guardian Interview	1 mother	1
Technology Specialist Interview		1
Student Interview	1 group of 4 male students (fourth year) 1 group of 4 female and 2 male students (fourth year)	2
Teacher Interview	4 teachers who were actively involved in and strongly identified with the reform. 2 teachers who were opposed to the re- form.	6

Questionnaire		
ICT Use Survey of Teachers	Teacher	10

Observing in Classrooms			
	Computer science	Fourth year	4 hours
	English	Second year	1 hour
	Mathematics	Fourth year	1 hour

Collecting additional materials		
	Web-site presentation	http://www.euhs-hall.tsn.at
	Reports and addresses from ICT projects	ENIS, NETdays
	School profile	

Appendix B

ICT Use Survey for Teachers

10 teachers filled out this questionnaire (n = 10). The results are represented in percentage (100 %).

• How comfortable are you with using a computer to do each of the following? (Choices are: very comfortable, comfortable, somewhat comfortable, not at all comfortable)

		very	com-	somewhat	not at all
		com-	fortable	com-	com-
		fortable	Tortable	fortable	fortable
1.	write a paper	50.0	40.0	-	10.0
2.	search for information on the WWW	30.0	40.0	20.0	10.0
3.	create and maintain Web pages	20.0	10.0	-	70.0
4.	use a data base	20.0	20.0	20.0	40.0
5.	send or receive e-mail	60.0	20.0	-	20.0
6.	programming (e.g. writing a program in Visual BASIC or Java)	-	20.0	-	80.0
7.	draw a picture or diagram	20.0	20.0	20.0	40.0
8.	present information (e.g. use Power- Point or equivalent	-	20.0	10.0	70.0

• During the past school year, how often did your students on average do the following for the work you assigned? (Choices are: several times each week, several times each month, a few times, never)

		several	several	a few	never
		times each week	times each month	times	
9.	use the World Wide Web	10.0	30.0	50.0	10.0
10.	create web pages	-	10.0	20.0	70.0
11.	send or receive e-mail	10.0	20.0	60.0	10.0
12.	use a word processing program	20.0	30.0	40.0	10.0
13.	use a computer to play games	-	-	70.0	30.0
14.	use a spreadsheet	10.0	10.0	30.0	50.0
15.	use a graphics program	-	20.0	40.0	40.0
16.	join in an on-line forum or chat room	-	10.0	70.0	20.0
17.	use a presentation program (e.g., PowerPoint)	-	-	10.0	90.0
18.	use an instructional program (includ- ing simulations)	-	30.0	40.0	30.
19.	other computer uses (specify)	-	-	70.0	30.0
20. How would you rate your ability to use a computer? (Choices are: good, fair, poor)

44.4	good
22.2	fair
33.3	poor

21. Was student computer use ever evaluated for grading? (yes-no)

40.0	yes
60.0	no

22. If you assigned World Wide Web searching, how much freedom did you allow stu dents in locating sites to visit? (no restrictions, some restrictions, designated sites only)

30.0	no restrictions
60.0	some restrictions
10.0	designated sites only

23. Did you create or modify a Web site with any of the classes that you taught? (yes-no)

30.0	yes
60.0	no

24. What portion of the computer use in your classes was directly related to the course content (as opposed to rewards or incentives, for example)? (all, most, some, very little)

10.0	all
10.0	most
20.0	some
60.0	very little

25. What portion of the computer use that you assigned is done by students individually? (all, most, some, very little)

10.0	all
40.0	most
20.0	some
30.0	very little

26. How often did you use a computer at home for preparing for teaching? (several times a week, several times a month, a few times, never)

50.0	several times a week
10.0	several times a month
30.0	a few times
10.0	never

27. Did you participate as a student or instructor in a virtual course through the Internet/World Wide Web? (yes-no)

10.0	yes
90.0	no

28. Did you involve your students in collaborative learning over the Internet/World Wide Web with students from other classes? (yes-no)

30.0	yes
70.0	no

29. Are you currently using technology to collaborate with other teachers (professional chat rooms, forums, or the like)? (yes-no)

20.0	yes
80.0	no

30. How many e-mail messages total do you send and receive each day on average? (more than 12, 6-11, 1-5, none).

20.0	more than 12
30.0	6-11
20.0	1-5
30.0	none

31. Have you ever done any of the following? (Choices are: yes, no)

		yes	no
a.	made changes to a computer's hardware	40.0	60.0
b.	updated an application program (word processor, graphics program, etc.)	40.0	60.0
с.	recovered a damaged file	40.0	60.0
d.	created a web site	30.0	70.0
e.	developed a data base	50.0	50.0

A Case Study of ICT and School Improvement at

Secondary School, Graz-Webling, Austria



February 26th, 2001

Overview of the present

Webling secondary school is a school site located in the southwest of Graz, the capital of Styria. Graz is the second largest town in Austria with about 240.000 inhabitants. Graz is also famous for its urban features and its culture. But there is also important industry which is located in the nearby surroundings. The school site itself is located in a suburban district. The social-economic status of the parents is mixed. Only a few parents have graduates in university. The percentage of foreigners is low. This type of school can only be found in Styria. The present school site was designed and established by the staff of Webling secondary school after an agreement with the authorities. Sometimes RS Webling had been called a "private school" with an autonomous status. But the financial resources has come from the government all the time. The development of this type of school is finished at the moment. But the development and improvement of the installed ICT will go on.

The main characteristics of the school site are:

- six instead of four grades the students have to complete
- some opportunities for the students to get familiar with professions, especially professions taken up by skilled workers
- the students can either take up a profession after the end of school or continue their education

A detailed overview of this type of school is given in the following report.

Overview of the past

The beginning of the reform process was the idea of changing the secondary school into a new type of secondary school. At that time ICT was implemented, but at a very low level. The development of the new type of school forced the developing team to include ICT to guarantee the best possible education in regard to the future profession of the students. The problems of the reform process were related to its contents, whereas the problems causes by the implementation of ICT were rather due to a lack of financial resources and the implementation team had little time to go ahead with it. The greater part of the staff did not take part in this process. And ICT-use in lessons is still not a normal procedure for the whole staff. Even nowadays a part of the staff is not familiar with this new technology.

Projection to the future

When ICT is part of a process it is not possible not to take part in the future development. The incredible speed of innovation in the field of ICT does not permit anyone to be idle. Therefore the main efforts including ICT at the moment are concerned with completing the system at the school site. The next step will be to update hard- and software in convenient intervals. To read about detailed investments please look at chapter "ICT infrastructure".

Conclusion about key hypothesis

Hypothesis 1

Technology is a strong catalyst for educational reform, especially when the World Wide Web is involved. The rival hypothesis is that where true reform is found, technology served only as an additional resource and not as a catalyst, that the forces that drove the reform also drove the application of technology to specific educational problems.

The analysis of the collected data indicates that hypothesis 1 can be verified by and large (just as in other IT schools). In the case of RS Webling the beginning point of the educational reform was the idea of the earlier principal to change his school site from a normal secondary school to a secondary school with six grades. The strong orientation towards requirements set up by future employers made it necessary to integrate information- and communication technologies at the same time. Before changing the type of school, the focus of RS Webling was technical works and creative drawing applied to crafts. Extending this focus would probably also have been the catalyst for a reform. Therefore in this case ICT has been one catalyst together with the intention of the staff

to create and implement a new type of school. The goal behind the reform was to attain a type of school, which would prepare the students more efficiently for their first step into any profession than normal secondary schools would do. Teachers expected that confronting students with needs of future jobs at an earlier moment, the students would achieve deeper knowledge about what's going on in real business life. The use of ICT in this context is one of the basic components for creating this type of school.

Hypothesis 2

The diffusion of the reform (and therefore of ICT) followed the traditional diffusion pattern for reforms and innovations, as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and reforms and that therefore different diffusion patterns occur.

Even in this case the diffusion of the organizational change followed the traditional diffusion pattern. ICT was one of the components of the changing process but it was not the driving force of the change at the start (just as in other IT schools). One of the first steps of some teachers interested in ICT was to get the qualifications for implementing and educating ICT at RS Webling by passing the examination for information science at the pedagogical academy. With the help of the parents' association, the first equipment for RS Webling was bought and installed. Later on even the school authorities supported the implementation of ICT.

As a special diffusion pattern the early involvement of RS Webling into the technology of the internet can be mentioned. RS Webling was the first school in Austria in 1993 to have their own Web page. This early involvement with new technology lead to special knowledge among teachers and students and enabled them to win several prices in specific competitions (for further details please visit the web site of the school, described under "characteristics of the school").

Hypothesis 3

Successful implementation of ICT depends mostly upon the technological infrastructure and student ICT competence rather than upon staff competence in the integration of ICT into instruction. The rival hypothesis is that teachers mediate such applications when they are successful, and that their academic value relates positively to teacher competence.

In fact, the rival hypothesis can be observed with the situation regarding the use of ICT just as in other IT schools. As figured out in hypothesis 2, a group of teachers had to get prepared for dealing with ICT. In case of RS Webling the group of teachers had to choose and install the required equipment by themselves.

Generally spoken, teachers of RS Webling confirmed, the more the staff is familiar and comfortable with using ICT, the more they will use ICT both for preparing their teaching and for their actual teaching. Without the necessary technical knowledge of the teaching staff the mediation of applications cannot be successful (just as in other IT schools). Moreover professional development plays a very important role. Due to the very strong involvement of the IT specialists in any questions of ICT this staff also σ-ganized internal further education for the rest of the teachers, and this was about the only organized educational training the staff got in this field. Only in exceptional cases the courses of the pedagogical institute (PI) were attended. Most of the staff, apart from the teachers of ICT, got their knowledge about ICT by internal training, asking colleagues or learning by doing, driven by their own interest.

The teachers imparting special ICT skills to the students are all qualified teachers for information science and therefore well trained. Besides these special lessons, at RS Webling ICT is also used in other classes e.g. languages or mathematics. The above mentioned internal training was offered especially to this group of teachers, who are normally not so comfortable with using ICT for teaching purposes.

As in other IT schools the main fear of many teachers was that the students could have more technical expertise than themselves. A further change must take place - a change in their own view. In this case teamwork is the magic word. Students and teachers have to constitute a team and then the process of learning can take place based on partnership.

Hypothesis 4

Gaps in performance between high and low poverty students will be enlarged rather than diminished where all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to high poverty students closing the gap with low poverty students.

The analysis of the collected data shows nearly the same result as the survey in other schools. In the case of equal access to ICT the performance of the students depends on their personal interest and involvement. On the one hand, equal access to ICT can be guaranteed during the lessons, but on the other hand the same cannot be guaranteed at home where students may use ICT for their homework or other practical work which may have to be done, especially up to the fourth class. Therefore the teachers try to create a balance between students with computer access at home and those who have no access by educating them in teams, where the better ones help the less skilled students.

Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

In fact academic standards are a result of both the teachers' and schools' expectations (just as in other IT schools). The teachers decide which teaching material will be used during the lessons. The task of the teachers is to select the material, which is beneficial for the students. If the teachers make a selection of the profitable ICT-teaching materials then ICT will not lead to a lowering of academic standards. At Webling secondary school the budget for ICT materials like learning software on CD-ROM's is not very high. So the purchased material must be carefully chosen, especially as there might be a lot of material with low academic standard.

The mostly used ICT source is the Web. However, if the teachers allow their students to browse in the Web without any restrictions and without any selection of special web sites then one expects too much from students. The students are not able to understand all kind of information, which they find in the Web.

In contrast to the other school sites included in this study, the students are of a higher age. Students between 14 and 16 years are already able to differentiate between profitable and useless information they get from the web. The teachers of this age group try to teach their students how to compare several sources of information from the web and to assess the accuracy of this information. The students are even taught to use several sources, i.e. different web sites.

Characteristics of the school

Name of school site	Haupt- und Realschule Graz-Webling
Address	A-8053 Graz, Unterer Bründlweg 19
Phone / Fax	+43-316/283563
Web site	http://www.rs-graz.asn-graz.ac.at
E-mail address – school site	rs-graz@rs-graz.asn-graz.ac.at
E-mail address - principal	direktion@rs-graz.asn-graz.ac.at
E-mail address - webmaster	webmaster@rs-graz.asn-graz.ac.at
Leadership	Principal: Mrs. Veronika Luidolt
Number of classes	11 classes
Number of students	262
Number of teachers	26
Kind of school	Secondary school for students between 10-16 years
Characteristics of school autonomy:	
	"Realschule" with six classes ending with a final
School experiment	examination "mittlere Reife", education especially
	for students who like to become skilled workers

	Information and communication technologies:
	IT is taught in all six years for two lessons a week.
	From the fifth class on special features are offered to
	the students in order to give them a qualified educa-
	tion for further jobs:
	- commercial – economical studies
	- technical studies
Extraordinary features	- social and human studies
	- applied information and communication technolo-
	gies
	Participation in projects like:
	- Comenius project
	- EU-project within "cyberschool"
	- museum online
	and more
Special features of the school site:	
	41 PC's, 1 Web-server, Win95 + Win2000, Office 97
	+ 2000; several software packages
3 Computer Labs	2 laser printers, 3 inkjet-printers, 1 scanner, 1 digital
	camera,
	1 Web-cam
Internet connection	standing wire connection to the Web
Sport and playing fields	soccer, basket ball, athletics

Evaluation of change

Diffusion patterns

The idea to create a new type of school arose in a discussion between the earlier principal with leading business people who complained about the poor qualifications any secondary school would provide for its students what their skills as future skilled workers were concerned. This discussion confirmed the principal in his idea to change the organization of his school together with his teachers. At last a team of teachers from different school types designed the model of a new secondary school, called "Realschule", with the goal to give students a better start into professional life. A small group of teachers watched the fast development in the field of information science and its use in industry. These teachers suggested to establish the application of information and communication technologies as a main focus of the curriculum for the new school model. They believed that ICT knowledge is one of the key qualification of skilled workers of the future. Supported by the principal this small group of teachers first improved their knowledge about information science and ICT by passing examinations at the pedagogical academy. There they got the basic information for planning and setting up the first equipment for their school. With financial support by the parents' association, at first five computers were bought and installed by the teachers themselves. Earning money by teaching courses in information science for the "Volkshochschule" (e.g. open university) and winning prices in competitions for schools provided them with the necessary means for buying more computers. When the amount of computers had increased at Webling secondary school, students did not only use the computer in specific ICT lessons, but they also got further access to computers in other subjects apart from **in**formation science. Up to now it has been almost always the same group of teachers who have kept the ICT-system running. Especially two teachers have become IT specialists and organized expansion, support and internal further education for the staff. Its mainly their credit that ICT is running at Webling secondary school.

Staff development & involvement

In no other subject the need for fundamental knowledge is as high as in information science. The number of children using computers at home is increasing and at the same time their age decreases. Its almost normal for children at the age of three or four years to play on the computers of their parents, if there is one at home. This means a very early contact with this medium. On the other hand, teachers with no ICT experience so far are forced, also by the authorities, to get that till the end of 2002. They meet children who are not afraid to deal with ICT. The education of students will change from teaching into a kind of working together in an atmosphere of partnership.

What kind of further education can teachers acquire?

At Webling secondary school the team who teaches ICT skills directly is well trained by the standards of the teaching profession. This team is automatically trained by their daily involvement in ICT use at the school site together with solving any occurring problems. This team consists of four or five people, the IT specialists included. Usually further education for teachers using ICT in addition to their usual classes consists of taking part in internal trainings, organized by the two IT specialists. Apart from introducing all the innovations of the schools' equipment training these specialists offer courses to examine the ECDL. Further training courses are also offered at the PI (pedagogical institute) or VHS (open university), but the staff does not very often take part in them because very often neither contents nor schedule meet the requirements.

It is not possible to attend any other IT courses offered as there is no money reserved in the school budget for such purposes. The financial resources are negligible if we look at the needs and wish of both the staff members and students to use ICT effectively at their school site.

Role of leadership

At Webling secondary school the same pattern can be seen as in other IT schools, where a small team of teachers occupied themselves with the development in the field of computer technologies. The beginning of the development started at a time, where Webling secondary school was a normal secondary school for children from 10 – 14 years. The team of teachers thought about integrating information technologies into the school curriculum at the end of the 80's. A small computer net of five computers was established first, sponsored by the parents' association. The experiences with this experiment were discussed with the principal and the staff at that time. A few years later the change of this secondary school into new type of secondary school started. Now nearly the whole staff stood behind the development of this focus and supported the team laying in mind the connection between both trends. The personal commitment of the IT team led to an additional income for the school site by educating adults in the evening or winning prices in competitions for schools. This team has been responsible for the implementation and development of ICT at Webling secondary school till now.

ICT-Reform Connections

The chapter about the role of leadership showed the close connection between the development of the new type of secondary school and the implementation of ICT at RS Webling. Both trends can not be separated any more, because of the very strong orientation towards the future professional life of the students. Teachers of RS Webling secondary school mentioned in their interviews a 1:1 relationship.

Outcomes

ICT Infrastructure

The following ICT infrastructure is situated at Webling secondary modern school:

a) <u>Hardware</u>

The computers of Webling secondary school are located in the following rooms: Three computer labs, conference room, principal's office and in the hall. A total number of 47 PC's are in use at the moment. The equipment of the PC's is shown in the following table:

Location	Number	Equipment
Computer Lab 1	15	Pentium III, 64 MB RAM, 700 MHz, CD-ROM, 17"
		Monitor each, one PC is equipped with a CD-writer
	1	Pentium II, 64 MB RAM, 233 MHz, CD-ROM, CD-
		writer,
		17" Monitor each
Computer Lab 2	15	Pentium II, 16 MB RAM, 150 MHz, 15 "Monitor each,
		one PC is equipped with a CD-ROM, another one with a
		ZIP-Drive
Computer Lab 3	11	486, 8-16 MB RAM, 66 MHz and less, 15" Monitor each,
		two PC's are equipped with a CD-ROM
Principal's office	1	Pentium II, 16 MB RAM, 233 MHz, CD-ROM, ZIP-
_		Drive,
		17" Monitor
Conference room	1	Pentium II, 16 MB RAM, 233 MHz, CD-ROM, 17" Moni-
		tor
Hall	3	486, 8-16 MB RAM, 66 MHz and less, 15" Monitor, uses
		as Internet terminals for students

Additional equipment: two laser printers, three inkjet-printers, one scanner, one digital camera and one Web cam. Most of the PC's are multimedia ready and connected to the Internet. At the moment of the inquiry additional PC's (486, 16 MB RAM, 66 MHz and less, 15" Monitor each) were handed over by a sponsor but not yet installed. There are provisions for the installation of two equipments each in the eleven classrooms and five special rooms to make internet access possible on the spot.

b) Software

<u>Installed software</u>: Windows 95 and Windows 2000, MS Office 97 and 2000, Auto-CAD Light, MS FrontPage 98 and 2000, Visual Basic 6.0, MS Publisher, Corel Draw 4.0, Shareware for graphic applications. <u>Learning software for</u>: Typing (shareware), Physics and Chemistry, Biology and Creative Work.

c) Internet and Provider

Internet access is managed by a Linux Server (Pentium II, 166 MHz). The school site is equipped with a permanent connection to the Web. Webling secondary school has its own domain and is a member of several school networks, for example "Webnetz Schulen" or "Schulweb-Ring". Students have access to the Web during lessons or by using the three terminals installed in the hall. Free access to the Web in the labs outside the lessons is not permitted for students because of the legal supervision. In lessons calling up unwelcome web sites is prevented on one hand by the teachers present, on the other hand by locking the access to certain web sites, mainly of pornographic or violent contents.

d) Support

Two teachers, called "Kustoden", the IT specialists of the school, guarantee support for the teachers and are authorized to change or repair any hardware by themselves. Software support is even managed by them. By being involved in any bigger or smaller problems in using ICT at Webling secondary school, the two teachers got a wide knowledge of ICT. For the problems they cannot solve, they contact colleagues or their friends. When working with external companies rather more problems occurred and help was not often provided because of the special needs caused by ICT at a school. The burden of the two IT specialists is enormous. Both are working as full time teachers. They are just paid for three hours a week for ICT support between the two of them. In order to improve support for teachers and hardware, at kast more than half of their weekly teaching commitment would have to be changed into support hours at the school, where these specialists are the only responsible people for support.

e) <u>E-mail</u>

Three official school e-mail accounts exist for this school site (see details on the chapter "characteristics of the school"). One for the principal, one for the webmaster of the school and an official e-mail account for the school. Each teacher at Webling secondary school has the opportunity to create his own web site and receive an official e-mail account by request. Most of the staff is using this official account. But also free e-mail accounts or accounts from private providers are used. But this is not the same for students. They get a free e-mail account under the guidance of the IT teachers. A private e-mail account however is advantageous when they leave the school site, so they can keep their address.

f) Use of ICT

Teachers and students use ICT for typing, for projects, spreadsheet analysis, word processing, preparing and giving presentations, programming (logo), creating and maintaining web pages, drawing pictures or diagrams and searching for information. Learning software is used in special subjects e.g. German, English, Physics, Biology or Creative Work.

g) Future perspectives

One of the next steps to enlarge the ICT equipment of this school site is to invest in a Windows 2000 terminal server. This investment enables the users to handle the older PC's as clients, where the latest software releases can be used. The IT specialists hope to finish this enlargement till the end of 2000. Another project is the implementation and networking of the sponsored computers into classrooms and special rooms. The ground for this project was prepared during vacation by laying the network wires to each room. After testing, repairing and configuring the sponsored PC's, installation and connection to the Web will be finished at the end of the school year 2000/2001. To practice the foreign languages, a language laboratory equipment will be established soon in one of the three computer labs.

Effectiveness

One teacher commented during the interview on the situation of schools changing to intensive ICT-use: "Mit der IKT bleibt kein Stein auf dem anderen", that means: "With ICT there will be no stone left on top of the others". Huge changes for Webling secondary school have arisen since the first computers were installed. The changes do not only concern the staff. Even lessons and the schools' equipment had to be adapted. During these exciting years, no staff member asked for transfer to another school site because of ICT implementation. Newcomers were asked about their interest in ICT to guarantee integration without any difficulties.

What are the positive and negative aspects of ICT at Webling secondary school?

Positive aspects:

- + the possibilities of communication enlarged by e-mail
- + increased access to information
- shyness of students to get in touch with ICT is decreasing, even if there is no access to ICT at home
- + ICT makes work much easier
- receptiveness to schools abroad, other countries or data bases have increased by using the Web or e-mail

Negative aspects:

- due to the access to ICT personal relations are reduced
- teachers have to receive a lot of the information students receive from the Web.
 Everybody believes the information gained from the Web is correct in the beginning.
- students are not supervised, especially at home, what they are doing with ICT. Web sites with unwelcome contents or games including violent scenes are called up.
- students spend a lot of time with ICT at home. Physical exercise declines to a minimum. Teachers of physical education watch a decreasing capacity of the students during the lessons.
- privacy is limited by ICT, when private data are sighted illegally or permanent response of people is expected (for example via mobile phone)

Besides these aspects, ICT also influences the social structure of the school. Only 4 teachers are involved intensively in ICT. They are responsible for imparting the main skills related to ICT. A very close relationship among them is the consequence. Another group of teachers have integrated ICT in their subjects like German, English, Biology and so on. They maintain a close relationship to the IT teachers to obtain information about news or help when problems arise. The last group consists of those teachers, who are not or have not yet been involved in ICT use on this school site. On the one hand, the reason could be, that there is no connection between ICT and their subject. On the other hand they may be afraid of using ICT together with students, because of the possible knowledge they might already have. If this group does not get familiar with ICT in the near future, the gap between this group and the rest of the teachers will increase and influence the structure in a negative way.

Another topic is the access to computer equipment at home, both for teachers and students. Teachers prepare their lessons most of the time at home. Intensive use of ICT when preparing lessons forces them to have a computer equipment at home. But in Austria no extra income is given to them to buy or maintain at home their "private" equipment they use for their jobs. Nevertheless, 80% of the teachers have some computer equipment at home. The number of students who have computers at home is about 40% and the share is increasing, the older the students are. Nearly every student from the fourth grade on has access to computer equipment at home. This is almost a necessity for them in order to do their studying.

Academic rigor

ICT is an important part of the school program of Webling secondary school. The central idea of RS Webling is the best possible preparation for future professions. Skills in ICT harmonize closely with this idea. A better view of the important role of ICT shows the academic schedule of the fifth and sixth grade in Appendix C. This schedule also shows the total number of classes per week the students of the fifth and sixth grade **a**tend. Together with the daily homework and the time spent on the computer at home for school the students feel like working up to 90 hours per week. Often they feel exhausted. The use of ICT during lessons depends on the classes the students attend. From first to third grade they have a weekly access on an average of 1 - 3 hours. The hours per week grow up from the fourth class on to a number of 4 - 10 classes. The block of information technologies takes up about 20 hours a week.

What applications are used? Most of the time during the lessons students work with word processing, spread sheet, presentation software, graphic software, data bank programs, visual basic and word training. They are also taught about hardware configuration and operating systems like DOS or WINDOWS.

Equity

Like in other IT schools the greatest difference which can be discovered among the students depends on the access of students to ICT at home. Students with a computer at home are better skilled because of a greater amount of practice. The teachers said once more, that owing a PC depends on the profession, interest and attitude of the parents. But several other studies in Austria show that low income families have significantly fewer PC's at home than families with higher incomes.

124

In case of gender the access to ICT is nearly the same. The difference is, that boys are technically oriented, while girls use ICT more as a communication platform. Another topic is the use of ICT by high or low ability students. High ability students use computers more as a tool, while low ability students like to see the computer as a play station. Differences can also be seen in the access of these two groups. High ability students build up their access of use on solid base. The increase of learning is therefore much higher as seen with low ability students, whose base is only fragmentary.

Projections

Sustainability

To maintain the school site was not a question at Webling. In contrast to other school sites RS Webling does not worry about decreasing numbers of students. The staff rather worry about the maintenance of the school type with its equipment on ICT and the improvement of both. In order to educate the students to deal with the equipment in a **e**-sponsible way, the teachers function as models, set up rules of behavior, prohibit dangerous things and tell the students why this is done.

To develop both the use of ICT and of the school type, four points were worked out as the key factors:

- financial resources
- well trained staff and interested newcomers
- effective praise and appreciation the principal can give to his staff
- responsibility of a team or work group for developing the school site. That can't be a question of one or two people only.

Especially what ICT is regarded the system itself takes care of its improvement. Differently to traditional subjects in ICT lessons the teachers are faced with a real challenges by the students. Their interest is that high that the teachers are forced to improve their knowledge and lessons all the time. At last the responsibility for improving the school system in Austria and its branches lies with the authorities. If there are more restrictions for the school sites than support, the motivation of the staff in improving education work is decreasing rapidly. One example for such restrictions is the so called § 61. Teachers with additional hours don't get their money for these hours, if they are absent on that day the should have been held. It does not matter, if the teacher was ill, made excursions with the students or took place in further education for example. You may say, the teachers were punished in case for activities outside the school building. A similar situation can be seen what the IT specialists are concerned: at RS Webling the two specialists were only paid for three hours a week, regardless there is a lot of work or none at all. One teacher explained this situation aptly "exploitation of idealists".

Scalability

As a result of the above statements, Webling secondary school is the best equipped school site at the end of the year 2000/2001 of the school sites taken into consideration for this study. Nevertheless, at RS Webling full implementation of ICT only will occur, when all wishes about a convenient expandation will be granted. All responsible people are aware of the efforts that have to be made to keep the equipment up to date. Only small steps can be done in future to enlarge the equipment of these days.

Appendix A

Methodology

Description of the volume and type of data collected

Activity	Annotation	Amount
Verbal Interviews (approxim	nately 45-60 minutes each)	
Nomination Form for a School Site	Principal	1
Administrator Interview	Principal	1
Parents/Guardian Interview	representative of parents' club 1 mother at school 1 mother interviewed at home 1 father interviewed at home	4
Technology Specialist Interview	both IT specialists are full-time teachers the interview was taken together	2
Student Interview	1 group with 4 students (sixth year) 1 group with 5 students (fourth year)	2

8

18

Questionnaire

Teacher Interview

-	
ICT Use Survey of Teachers	Teacher

(Observing in labs	(at the time of visiting this school site no com- puters could be find in the class rooms)	
	Global communication	sixth year	1
	Geometricy	third year, group a	1
	Geometricy	third year, group b	1
	German	fourth year (use of ICT to gain material about poets)	1
	Physics	fourth year (subject energy)	1
	Creative Work	first year (make a sketch with Deluxe Paint)	1

(Collecting additional materials			
	Web-site-presentation http://www.rs-graz.asn-graz.ac.at			
	Booklet	Thermo-Profit: A project for energy safing inside the school		
	Dooklet	building of Webling secondary modern school.		
	2 school magazines	Second edition February 2000 and seventh edition June 2000		
Calendar 2000 including students paintings		including students paintings		
		Connecting all classes to the web by installing 2 computers		
	New visions and projects	each till the end of 2000. Installing a Terminal-server to use		
	New visions and projects	the PC's with low frequency as terminals in order to guaran-		
		tee problem-free access to office 2000 software.		

Appendix B

ICT Use Survey for Teachers

10 teachers filled out this questionnaire (n = 18). The results are represented in percentage (100 %).

• How comfortable are you with using a computer to do each of the following? (Choices are: very comfortable, comfortable, somewhat comfortable, not at all comfortable)

		very com- fortable	com- fortable	some- what com- fortable	not at all com- fortable
1.	write a paper	72.2	16.7	11.1	-
2.	search for information on the WWW	22.2	33.3	38.9	5.6
3.	create and maintain web pages	5.6	5.6	38.9	50.0
4.	use a data base	16.7	16.7	33.3	33.3
5.	send or receive e-mail	52.9	41.2	5.9	-
6.	programming (e.g. writing a program in Visual BASIC or Java)	-	16.7	16.7	66.7
7.	draw a picture or diagram	17.6	17.6	29.4	35.3
8.	present information (e.g. use Power- Point or equivalent	22.2	16.7	11.1	50.0

• During the past school year, how often did your students on average do the following for the work you assigned? (Choices are: several times each week, several times each month, a few times, never)

		several times each week	several times each month	a few times	never
9.	use the World Wide Web	18.8	18.8	18.8	43.8
10.	create web pages	6.3	-	6.3	87.5
11.	send or receive e-mail	6.3	-	18.8	75.0
12.	use a word processing program	29.4	17.6	17.6	35.3
13.	use a computer to play games	-	6.3	12.5	81.3
14.	use a spreadsheet	11.8	17.6	17.6	52.9
15.	use a graphics program	6.3	-	25.0	68.8
16.	join in an on-line forum or chat room	-	6.3	6.3	87.5
17.	use a presentation program (e.g. PowerPoint)	12.5	12.5	25.0	50.0
18.	use an instructional program (includ- ing simulations)	-	12.5	31.3	56.3
19.	other computer uses (specify)	-	18.8	12.5	68.8

20. How would you rate your ability to use a computer? (Choices are: good, fair, poor)

23.5	good
41.2	fair
35.3	poor

21. Was student computer use ever evaluated for grading? (yes-no)

38.9	yes
61.1	no

22. If you assigned World Wide Web searching, how much freedom did you allow students in locating sites to visit? (no restrictions, some restrictions, designated sites only)

16.7	no restrictions
66.7	some restrictions
16.7	designated sites only

23. Did you create or modify a Web site with any of the classes that you taught? (yes-no)

15.4	yes
84.6	no

24. What portion of the computer use in your classes was directly related to the course content (as opposed to rewards or incentives, for example)? (all, most, some, very little)

7.1	all
14.3	most
35.7	some
42.9	very little

25. What portion of the computer use that you assigned is done by students individually? (all, most, some, very little)

-	all
35.7	most
42.9	some
21.4	very little

26. How often did you use a computer at home for preparing for teaching? (several times a week, several times a month, a few times, never)

76.5	several times a week
5.9	several times a month
17.6	a few times
-	never

27. Did you participate as a student or instructor in a virtual course through the Internet/World Wide Web? (yes-no)

41.2	yes
58.8	no

28. Did you involve your students in collaborative learning over the Internet/World Wide Web with students from other classes? (yes-no)

5.6	yes
94.4	no

29. Are you currently using technology to collaborate with other teachers (professional chat rooms, forums, or the like)? (yes-no)

27.8	yes
72.2	no

30. How many e-mail messages total do you send and receive each day on average? (more than 12, 6-11, 1-5, none).

11.1	more than 12
33.3	6-11
50.0	1-5
5.6	none

31. Have you ever done any of the following? (Choices are: yes, no)

		yes	no
a.	made changes to a computer's hardware	41.2	58.8
b.	updated an application program (word processor, graphics pro- gram, etc.)	61.1	38.9
с.	recovered a damaged file	55.6	44.4
d.	created a web site	29.4	70.6
e.	developed a data base	33.3	66.7

Appendix C

Academic Schedule

New secondary school grades 1 to 4

The academic schedules of the new type of secondary school do not differ from the schedules of the normal secondary school from the first up to the third.

In the fourth grade classes of a second foreign language (French or Italian) start.

In addition, the students of the fourth grade complete three blocks of teaching corresponding with the focus in the fifth and sixth grade within eleven weeks each during the year.

Academic schedules of the fifth and sixth grades at Webling secondary school:

The following academic schedule is the same for all students of the fifth grade:

General education 5. grade

subject	weekly hours
Religious education	2
German	4
English	3
Second foreign language	3
Social aspects of Economics & History	1
Mathematics	3
Physics and Chemistry	1
Health care and Biology	1
Profession orientation	1
Development of the personality and behavior during leisure time	1
Physical education	2
Subjects taught in blocks	13
total	35

The students of the fifth grade choose one of the following three blocks (same again as in the sixth grade):

Information technologies block 5. grade

subject	weekly hours
Software	3
Human science aspects of IT	1
Hardware configuration with practice	3
Global communication	2
Programming	2
Theoretical foundation	1
Typing	1

Economics and social science block 5. grade

subject	weekly hours
Home economics, kitchen manage- ment	4
Accountancy	1
Business management	1
Information and communication tech- nologies	2
Social – economic practice	3
Typing	1
Economical arithmetics	1

Technical block 5. grade

subject	weekly hours
Basic technologies:	
Mathematics	1
Chemistry	1
Electronics	1
Physics	2
Information and communication tech- nologies	2
Typing	1
Technical drawing	2
Workshop practice	3

General education 6. grade

subject	weekly hours
Religious education	2
German	3
English	3
Second foreign language	3
Social aspects of Economics & History	2
Political education	2
Philosophy and Psychology	1
Mathematics	2
Advanced Health Care	1
Profession orientation	2
Physical education	2
Subjects taught in blocks	12
total	35

Information technologies block 6. grade

subject	weekly
Software	3
Hardware configuration with practice	3
Global communications	2
Programming	2
Projects	2

Economic – social block 6. grade

subject	weekly hours
Home economics, kitchen manage- ment	3
Business management organization	3
Social – economic practice	2
Information and communication technologies	2
Projects	2

Technical block 6. class

subject	weekly hours
Basic technologies:	
Mathematics	1
Chemistry	1
Electrical engineering	1
Physics	1
Information and communication technologies	2
Projects	2
Workshop practice	3

3 Conclusions

The following three sections summarize the most important results obtained through the analysis of the case studies. The section entitled "Challenge for the future" shows which tasks most urgently need to be carried in the near future.

3.1 The beginning of ICT in schools

The starting points for the ICT implementation in each secondary schools are almost the same. Those responsible wanted to both stop the decrease in enrollment and increase the level of student performance. The implementation of an ICT emphasis is being carried out haphazardly and does not following a systematic, carefully developed plan (exception: Vienna). In fact, the implementation of any kind of emphasis depends on the skills and the motivation of certain teachers. All of the schools investigated had a couple of teachers who were interested and well trained in ICT and very engaged. If there were no teachers with these abilities and attitudes, the school did not start the ICT implementation. At the beginning, the other teachers adopted a wait and see policy. The working atmosphere at the school played an important role during this stage of development. If the working atmosphere was positive and trusting, then even teachers with little or no ICT knowledge would find it easier to acquire computer skills and integrate ICT into their preparation and teaching. If the working atmosphere was bad, these teachers were not motivated to learn ICT skills. The result was a sharp division among teachers. Another distinct characteristic of the beginning of an ICT implementation is the acquisition and organization of all the hardware and software. This was carried out by the principal of each school and financed by the municipality and sometimes private sponsors (e.g. interested companies in the vicinity). However, the installation of the ICT network was carried out by the ICT-oriented teachers themselves, who displayed an unusual amount of enthusiasm and willingness to invest many unpaid hours in their spare time. One exception: in Vienna schools, the ICT installation was done by the "call center" of the local school administration.

3.2 The status quo

A look at the *status quo* in each of the schools investigated shows that the while the system is functioning, there are still problems to be solved.

- Hardware and software problems are an almost daily occurrence in some schools (e.g. Vienna). The hardware and software support is insufficient and often disorganized. In most schools, the IT specialists repair the defective hardware themselves. Only in Vienna schools is the support organized by a higher authority, but the waiting time for the support is often very long.
- A further result of this unsatisfactory situation is that all IT specialists at the five schools are completely overworked.
- The success of students' ICT work depends on whether or not they have a PC and Internet access at home. Having or not having a PC is a question of social stratification.
- Most of the teachers are willing to participate in ICT further education. At present, the problem in each federal province is that although the number of special ICT trainings has increased each year, it still can not satisfy the demand. A second problem is that the PI offers more elementary than advanced ICT trainings, which the IT specialists urgently need to maintain and support the network.

3.3 Hypotheses

3.3.1 Hypothesis 1

Technology is a strong catalyst for educational reform, especially when the World Wide Web is involved. The rival hypothesis is that where true reform is found, technology serves only as an additional resource and not as a catalyst, and that the forces that drove the reform also drove the application of technology to specific educational problems.

The ICT implementation has changed things in the schools investigated, but no great educational reform has taken place in Austria. At present, it is possible to identify three positive results brought about by the ICT emphasis in the selected schools:

- 1. an increase in student enrollment
- 2. more students with high abilities attend the ICT emphasis
- 3. increased reflection on some processes, e.g. teaching, organizing of schedules, etc.

The great educational reform, however, failed to address basic conditions (legislative and administrative).

3.3.2 Hypothesis 2

The diffusion of the reform (and therefore of ICT) followed the traditional diffusion pattern for reforms and innovations as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and reforms and that different diffusion patterns therefore occur.

The ICT implementation was always started by a small team of teachers who were interested in ICT. The ICT emphasis spread throughout the school (Kinkplatz) but often involved only a minority of teachers. This development depends on three factors:

- the working atmosphere in general
- the demographic composition of the teaching staff (e.g. age, gender) and
- the readiness of teachers to try something new

3.3.3 Hypothesis 3

Successful implementation of ICT depends mostly upon the technological infrastructure and student ICT competence rather than upon staff competence in the integration of ICT into instruction. The rival hypothesis is that teachers mediate such applications when they are successful, and that their academic value relates positively to teacher competence.

In the long term, it is important that the technological infrastructure really work; otherwise the teachers and IT specialists involved will be frustrated, and no meaningful planning is possible (e.g. planning of lessons, hardware and software updates, manpower planning, etc.). Furthermore, it is important for at least a couple of members of the teaching staff to be extraordinarily engaged and have very good ICT skills so they can support their colleagues. In fact, the rival hypothesis more accurately shows the status of ICT implementation. The more familiar and comfortable teachers are with using ICT, the more they will use it for their teaching preparation and for their actual teaching.

3.3.4 Hypothesis 4

Gaps in performance between high and low income students will be enlarged rather than diminished where all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to high poverty students closing the gap with low poverty students.

The problem, according to a majority of teachers, is that ICT widens the gap between students who have a PC and Internet access at home and those who don't. Students with a computer at home have better skills as a result of more practice. It would be a great challenge for the schools to introduce measures to close this gap.

3.3.5 Hypothesis 5

Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.

This hypothesis is answered indirectly, because the interviews didn't contain the necessary data. The analysis of the data collected indicates that ICT does not lead to higher or lower academic standards but that it does improve the form and appearance of work students and teachers present.

3.4 Challenges for the future

- It is important for all teachers to get basic ICT-training, in subjects, in which ICT is didactically meaningful, but without the current pressure from the school administration, which quite obviously creates resistance and frustration.
- It is important that all IT specialists have the opportunity to attend special IT courses for their needs (high level ICT training)
- There must be a guarantee of reliable hardware and software support as well as a plan for replacing outdated equipment.
- There must be better compensation for ICT support. At present, all the IT specialists invest a great deal time in keeping the system working and are completely overworked.
- The ICT emphasis should achieve the same status that music or sports have in special secondary schools. At present, ICT-based schools in Austria do not enjoy the same advantages as schools based on another main emphasis.